Environmental Assessment of the USEC Inc. American Centrifuge Lead Cascade Facility at Piketon, Ohio

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U.S. Nuclear Regulatory Commission
Office of Nuclear Material Safety and Safeguards
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ABSTRACT

The U.S. Nuclear Regulatory Commission (NRC) Office of Nuclear Material Safety and Safeguards (NMSS) prepared this Environmental Assessment (EA) in response to a license application filed by USEC Inc. USEC Inc. has requested a license (Docket Number 70-7003) for possession and use of special nuclear material in the American Centrifuge Lead Cascade Facility at the Portsmouth Gaseous Diffusion Plant (PORTS) located in Piketon, Ohio. The EA has been prepared in accordance with the *U.S. Code of Federal Regulations*, 10 CFR Part 51, which implements the requirements of the *National Environmental Policy Act* (NEPA) of 1969, as amended (P.L. 91-190).

Existing facilities formerly used for the Gas Centrifuge Enrichment Plant at PORTS will be leased from the U.S. Department of Energy and utilized for the Lead Cascade. The proposed action includes refurbishment of facilities (including the partial or total removal and disposal of abandoned 1980s vintage centrifuge machines and miscellaneous parts and equipment, and the installation, start-up, and operation of up to 240 full-scale gas centrifuge machines (forming a cascade) in the recycle mode as a “closed-loop” system and components. The purpose of the applicant’s proposal is to provide the necessary technical and cost information to assist in determining whether the advanced uranium enrichment technology will support proceeding with the Commercial Plant.

On the basis of this EA, the NRC staff has concluded that environmental impacts associated with the proposed action would not be significant and do not warrant the preparation of an Environmental Impact Statement.

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SUMMARY AND CONCLUSIONS

The U.S. Nuclear Regulatory Commission (NRC) has prepared this Environmental Assessment (EA) in response to a license application (Docket Number 70-7003) submitted by USEC Inc. in February 2003 for the construction of the American Centrifuge Lead Cascade Facility, a test and demonstration facility designed to provide information on the American Centrifuge technology. USEC Inc. proposes to construct this facility within existing facilities at the Portsmouth Gaseous Diffusion Plant (PORTS) located in Piketon, Ohio. On the basis of the assessment, the NRC staff has concluded that environmental impacts associated with the proposed action would not be significant and do not warrant the preparation of an Environmental Impact Statement. Accordingly, it has been determined that a Finding of No Significant Impact is appropriate.

In accordance with 10 CFR 2.790 of the NRC's "Rules of Practice," the EA and the documents related to this proposed action will be available electronically for public inspection from the NRC's document system (ADAMS). ADAMS is accessible from the NRC Web site at http://www.nrc.gov/reading-rm/adams/web-based.html (The Public Electronic Reading Room).

FOREWORD

The U.S. Nuclear Regulatory Commission will consider the information in this report in the review of the license application by USEC Inc. to construct and operate a test and demonstration facility for a uranium enrichment process to be located at the Portsmouth Gaseous Diffusion Plant near Piketon, Ohio. This report documents the potential environmental impacts of the proposed action.

ACRONYMS AND ABBREVIATIONS

BLS	Bureau of Labor Statistics
CAA	*Clean Air Act of 1970*
CAP	Corrective Action Program
CEDE	Committed Effective Dose Equivalent
CEQ	Council on Environmental Quality
CFR	*U.S. Code of Federal Regulations*
CoC	Certificate of Compliance
CRADA	Cooperative Research and Development Agreement
D&D	decontamination and decommissioning
DOA	U.S. Department of Agriculture
DOE	U.S. Department of Energy
DOT	U.S. Department of Transportation
EA	Environmental Assessment
ER	Environmental Report
EDE	effective dose equivalent
EIS	Environmental Impact Statement
EPA	U.S. Environmental Protection Agency
ERPG	Emergency Response Planning Guide
ETTP	East Tennessee Technology Park
EV	evacuation vacuum
GCEP	Gas Centrifuge Enrichment Plant
GDP	gaseous diffusion plant
GVW	gross vehicle weight
HEU	highly enriched uranium
HPS	Health Physics Society
ICRP	International Commission on Radiological Protection
IGWMP	Integrated Ground-Water Monitoring Plan
IROFS	items relied on for safety
ISA	Integrated Safety Analysis
LEU	low enriched uranium
LLMW	low-level mixed waste
LLRW	low-level radioactive waste
MCW	machine cooling water
MEI	maximally exposed individual

NAAQS	National Ambient Air Quality Standards
NAC	Noise Ambient Criteria
NCRP	National Council on Radiation Protection and Measurements
NEPA	*National Environmental Policy Act*
NESHAP	National Emissions Standards for Hazardous Air Pollutants
NMSS	Office of Nuclear Material Safety & Safeguards
NPDES	National Pollutant Discharge Elimination System
NRC	U.S. Nuclear Regulatory Commission
NRCE	National Register Criteria for Evaluation
NRCS	Natural Resources Conservation Service
NRERP	National Resources and Environmental Research Program
NRHP	National Register of Historic Places
OAC	Ohio Administrative Code
ODH	Ohio Department of Health
ODNR	Ohio Department of Natural Resources
ODOT	Ohio Department of Transportation
PCB	polychlorinated biphenyl
PGDP	Paducah Gaseous Diffusion Plant
PORTS	Portsmouth Gaseous Diffusion Plant
PSD	prevention of significant deterioration
PV	purge vacuum
RAI	request for additional and supplementary information
RCRA	*Resource Conservation and Recovery Act of 1976*
RCW	recirculating cooling water
ROI	region of influence
SER	Safety Evaluation Report
SARA	*Superfund Amendments Reauthorization Act*
SHPO	State Historic Preservation Office
SILEX	Separation of Isotopes by Laser Excitation
SR	State Route
STP	Sewage Treatment Plant
^{99}Tc	technetium-99
TCE	trichloroethylene
TEDE	Total Effective Dose Equivalent
$^{233/234}U$	uranium 233/234

^{235}U	uranium-235
^{236}U	uranium-236
^{238}U	uranium-238
UF_6	uranium hexafluoride
UF_4	uranium tetrafluoride
$^{235}UF_6$	uranium hexafluoride-235
$^{238}UF_6$	uranium hexafluoride-238
UO_2F_2	uranyl fluoride
USCB	U.S. Census Bureau
USFWS	U.S. Fish and Wildlife Service
VOC	volatile organic compound

UNITS OF MEASURE

C	Celsius
Ci	curie
cm	centimeter
CO	carbon monoxide
F	Fahrenheit
ft	foot
ft^2	square feet
ft^3	cubic feet
ft^3/h	cubic feet per hour
g	gram
Gal	gallon
Gal/yr	gallons per year
GPD	gallons per day
ha	hectare
HF	hydrogen fluoride
h	hour
in	inch
kg	kilogram
kg/h	kilogram per hour
km	kilometer
km^2	square kilometers
km/h	kilometers per hour
L	liter
lbs	pounds
lbs/h	pounds per hour
L/d	liters per day
L/h	liters per hour
m	meter
m^2	square meters
m^3	cubic meters
m^3/h	cubic meters per hour
m/s	meters per second
mCi	millicurie (one-thousandth of a curie)
mg	milligram (one-thousandth of a gram)

MGD	million gallons per day
mg/m^3	milligrams per cubic meter
mi	mile
mi^2	square miles
mi^3/d	cubic miles per day
mbtu	million british thermal unit
mph	miles per hour
mrem	millirem (one-thousandth of a rem)
MW	megawatt
NO_2	nitrogen dioxide
NOX	nitrogen oxides
O_3	ozone
PCB	polychlorinated biphenyl
pCi/m^3	picocurie (one-trillionth of a curie)/cubic meter
PM^{10}	particulate matter (less than 10 microns in diameter)
ppm	parts per million
rem	roentgen equivalent man
RM	river mile
SO_2	sulfur dioxide
SWU	separative work units
yr	year
μCi	microcurie (one-millionth of a curie)
$\mu Ci/g$	microcuries per gram
μg	microgram (one-millionth of a gram)
$\mu g/kg$	micrograms per kilogram
$\mu g/L$	micrograms per liter
$\mu g/m^3$	micrograms per cubic meter
wt	weight

1 PURPOSE AND NEED

1.1 Introduction

Uranium enrichment is a step in converting natural uranium to nuclear fuel for use in commercial nuclear power plants, research reactors, and naval propulsion reactors. Enrichment is the process of augmenting the percentage of the naturally occurring and fissionable uranium-235 (^{235}U) isotope and decreasing the percentage of uranium-238 (^{238}U). Uranium ore usually contains approximately 0.7 weight percent ^{235}U, and this percentage is significantly less than the ^{235}U with 4 to 5 weight percent enrichment specified by nuclear power plants as fuel components for electricity generation. The Separative Work Unit, or SWU, is defined as a measure of the effort required in an enrichment facility to separate uranium of a given ^{235}U content into two fractions, one with a higher percentage and one with a lower percentage of ^{235}U. Over the past 50 years, a number of uranium enrichment facilities have been used in the United States. However, only one U.S. uranium enrichment facility in Paducah, Kentucky, is currently in operation.

The U.S. Nuclear Regulatory Commission's (NRC) Office of Nuclear Material Safety and Safeguards (NMSS) prepared this Environmental Assessment (EA) in response to a license application filed by USEC Inc. USEC Inc. has requested a license for possession and use of source and special nuclear material in a demonstration project to be built at the Portsmouth Gaseous Diffusion Plant (PORTS) located in Piketon, Ohio. The EA was prepared in accordance with the *U.S. Code of Federal Regulations,* 10 CFR Part 51, which implements the requirements of the *National Environmental Policy Act* (NEPA) of 1969, as amended (P.L.91-190).

USEC Inc. is a domestic provider of enriched uranium to the nuclear industry. Currently, the United States Enrichment Corporation, a subsidiary of USEC Inc., operates the Paducah Gaseous Diffusion Plant (PGDP) in Paducah, Kentucky. In May 2001, the United States Enrichment Corporation suspended uranium enrichment operations at PORTS.

PORTS was also the home of a U.S. Department of Energy (DOE) gas centrifuge uranium enrichment facility in the early 1980s that was partially constructed. As part of this project, approximately 800 machines were briefly operated to demonstrate the process. Uranium hexafluoride (UF_6) feed material was processed through some of the machines prior to abandoning the project (DOE, 2003). USEC Inc. is investigating the possibility of replacing the existing and idled gaseous diffusion enrichment technology with a more efficient enrichment technology using high-speed gas centrifuge machines. This proposed action, known as the American Centrifuge Lead Cascade Facility (the Lead Cascade), will operate up to five years and be located in the existing gas centrifuge facilities at PORTS where DOE operated the old gas centrifuge machines. USEC Inc. will use the reliability, performance, cost, and other data collected from the Lead Cascade to make decisions concerning the deployment of a commercial plant at either Paducah, Kentucky, or Portsmouth, Ohio.

On February 12, 2003, in accordance with 10 CFR Part 51, the applicant submitted an Environmental Report (ER) (USEC, 2003a) along with its license application (USEC, 2003b). The ER and subsequent revisions (USEC, 2003c) provide the background materials for this EA. The NRC staff has conducted its own environmental reviews by meeting with the applicant's staff, conducting site visits, and requesting additional and supplementary information (RAI) to ensure a thorough understanding of the proposed action.

1.2 Background

PORTS is an idle gaseous diffusion plant that is established on a fully developed industrial reservation. DOE owns the uranium enrichment production and operations facilities on the site and will lease the buildings necessary to support the Lead Cascade to USEC Inc. through its subsidiary, the United States Enrichment Corporation. PORTS is located in a rural area of Pike County in south central Ohio on a 15-square-kilometer (km^2) or 5.8-square-mile (mi^2) reservation approximately 6 km (4 mi) south of Piketon, Ohio, and about 35 km (22 mi) north of Portsmouth on U.S. Route 23 (Figure 1-1).

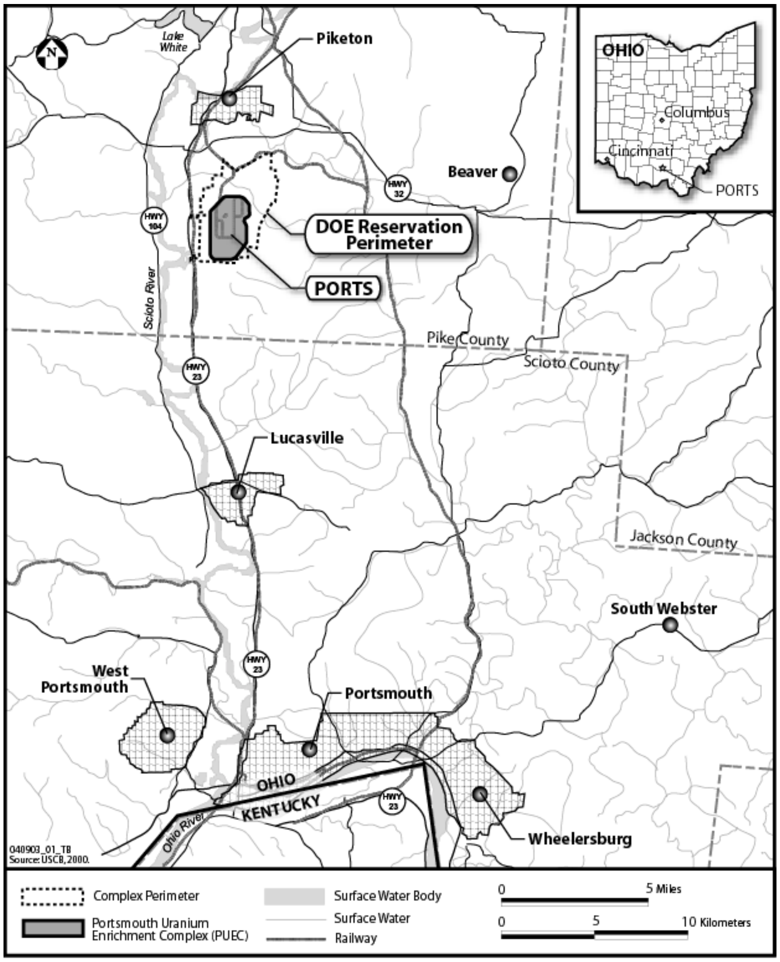

Figure 1-1 Geographical Location of PORTS

PORTS began operations in 1954 as part of a U.S. Government expansion program for the production of highly enriched uranium (HEU) to fuel military reactors and nuclear weapons production. In the late 1970s, PORTS was selected for the new gas centrifuge enrichment facility technology. The construction for this new facility was initiated in 1979, but it was halted in the 1980s as the demand for enrichment dropped.

In 1991, PORTS suspended production of HEU and subsequently revised their mission to produce low-enriched uranium fuel (LEU) (4 to 5 weight percent enrichment of ^{235}U) for commercial nuclear power plants. In 1993, DOE assigned control of operations to the United States Enrichment Corporation, a federal corporation, in an effort to commercialize the uranium enrichment production. In 1998, USEC Inc. was privatized. In May 2001, the United States Enrichment Corporation fully ceased uranium enrichment operations at PORTS. The following year, all PORTS transportation and enrichment activities were consolidated at PGDP.

PORTS is now in cold standby status, which involves placing those portions of the gaseous diffusion plant needed for 3 million SWU per year production capacity in a non-operational condition. In addition, necessary surveillance and maintenance activities must be conducted to retain the ability to resume operations after a set of restart activities are conducted. The United States Enrichment Corporation is providing uranium deposit removal and winterization services as well as a range of specialized support services for DOE and its contractors, including the decontamination of uranium feed material.

PORTS currently operates in accordance with an NRC Certificate of Compliance (CoC) issued pursuant to 10 CFR Part 76 requirements. These operations are listed in USEC Inc.'s license application and include maintaining PORTS in cold-standby status under a contract with DOE, performing uranium deposit removal activities in the cascade facilities, and removing technetium-99 (^{99}Tc) from potentially contaminated uranium feed in accordance with the June 17, 2002, agreement between USEC Inc. and DOE (USEC, 2003b).

1.3 Overview of the American Centrifuge Lead Cascade

USEC Inc. has entered into a partnership with University of Tennessee-Battelle, the operator of DOE's Oak Ridge National Laboratory, to refine gas centrifuge technology under a DOE-approved Cooperative Research and Development Agreement (CRADA).

On June 17, 2002, USEC Inc. and the Federal Government (represented by DOE) entered into an agreement that mandates as one of its fundamental objectives the deployment of new, cost-effective centrifuge enrichment technology in the United States (herein known as the DOE-USEC Agreement). Assuming successful demonstration of the technology, the DOE-USEC Agreement requires that USEC Inc. commences operation of a commercial enrichment plant with an annual capacity of 1 million SWU in accordance with certain milestones.

The DOE-USEC Agreement presents three phases towards the development of a full commercial gaseous centrifuge enrichment plant (Commercial Plant). The first phase includes research and development of the centrifuge components at DOE's East Tennessee Technology Park (ETTP) in Oak Ridge, Tennessee. The activities associated with this early phase were covered in a separate DOE EA (DOE, 2002). The second phase of the DOE-USEC Agreement encompasses the Lead Cascade activities covered under this EA. The Commercial Plant construction and operation, which constitutes the third phase of the DOE-USEC Agreement, will be addressed through a separate and future NRC licensing action that includes separate NEPA documentation. Figure 1-2 presents the milestones and schedule of these three phases.

1.4 The Applicant's Proposal

USEC Inc. applied to the NRC for a license to possess and use source and special nuclear material at the Lead Cascade at PORTS located in Piketon, Ohio, in accordance with the DOE-USEC Agreement. USEC Inc. will lease the existing facilities formerly used for the Gas Centrifuge Enrichment Plant at PORTS and use the facilities for the Lead Cascade. The proposed action includes refurbishment of facilities including the partial or total removal and disposal of abandoned 1980s vintage centrifuge machines and miscellaneous parts and equipment (DOE, 1976; DOE, 1977). In addition, the proposed action includes the installation, start-up, and operation of up to 240 full-scale gas centrifuge machines (forming a cascade) in the recycle mode as a "closed-loop" system and components. The refurbishment requires approximately 22 months to complete and includes 9 months for preliminary cleanout of the facilities of existing equipment and waste material. These cleanout activities should begin around October 2003 prior to about 13 months of facility upgrade for the Lead Cascade operations that should commence around August 2004. Additional gas centrifuge machines may be available as spares.

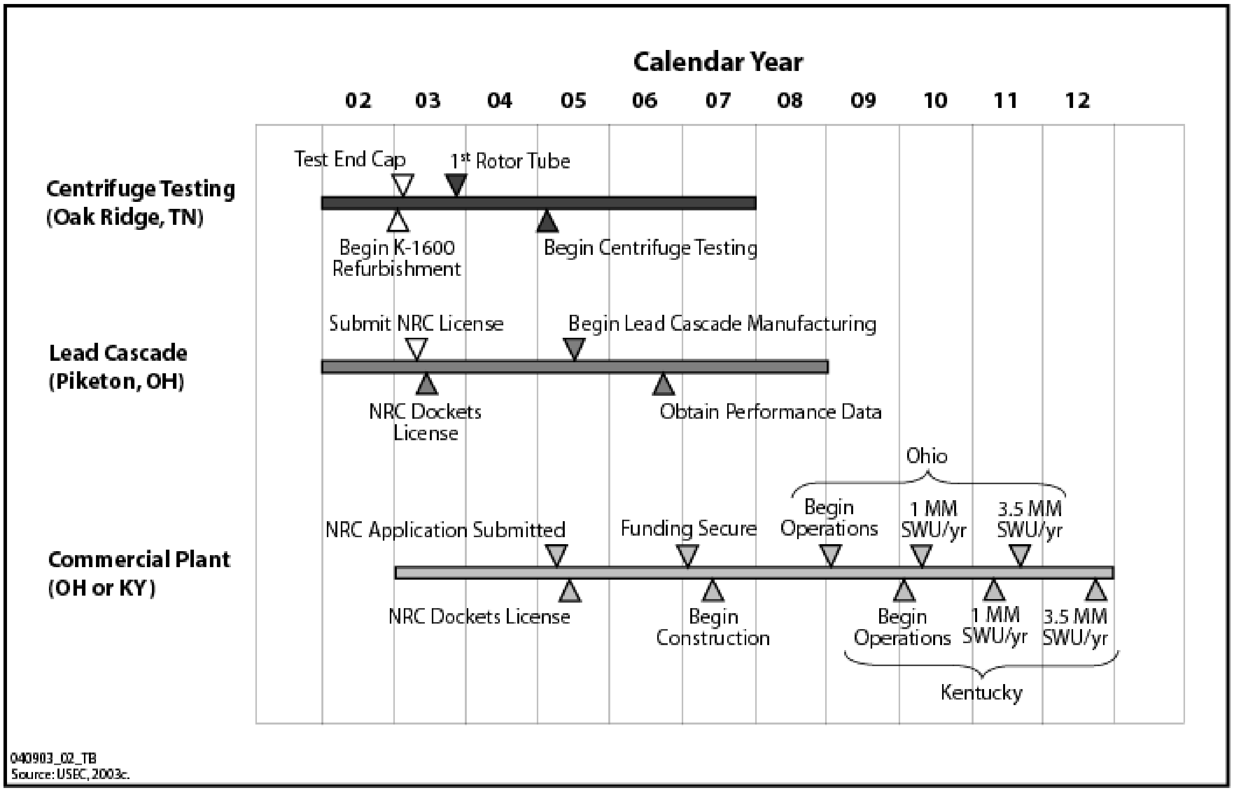

Figure 1-2 The Three Phases and Schedules Towards the Development of a Fully Operational Commercial Plant Using the American Centrifuge Technology

The Lead Cascade may possess up to 250 kilograms (kg) uranium hexafluoride (UF_6) and may enrich the UF_6 up to 10 weight percent ^{235}U. The cascade is operated in recycle mode where the enriched product stream is recombined with the depleted stream prior to being re-fed to the cascade. Samples of UF_6 are taken for laboratory analysis to assess the performance of the cascade. Other operations that are performed to support the primary process include equipment and machinery repair and fabrication of specialized equipment. These activities may be conducted with equipment contaminated with uranium-bearing material. The uranium-bearing material could be UF_6, uranium tetrafluoride (UF_4), uranyl fluoride (UO_2F_2), or an intermediate oxy-fluoride.

The Demonstration Project will show that the centrifuge machine design is capable of economically producing more than 300 SWU annually. The Lead Cascade will provide data that are vital to reducing the financial risks associated with reliability, performance, licensability, and cost associated with Commercial Plant deployment (USEC, 2003a).

1.5 Purpose and Need of the Applicant's Proposal

The United States Enrichment Corporation was created under the *Energy Policy Act* of 1992 as a wholly owned government corporation and was privatized under the *USEC Privatization Act* of 1996 to perform, among other things, two important tasks. These tasks include conducting research and development as required to evaluate alternative technologies for uranium enrichment, and supporting the national energy security goals that include maintaining a reliable and secure domestic source of enriched uranium. As a result, the congressional action followed by the DOE-USEC Agreement established a USEC Inc. national mandate to begin operations of a uranium enrichment facility (the Commercial Plant) at PORTS or PGDP using advanced uranium enrichment technology with an annual capacity of 1 million SWU (expandable to 3.5 million SWU) in accordance with certain milestones. However, before proceeding with the design, licensing, construction, and operation of the Commercial Plant, USEC Inc. must demonstrate acceptable reliability, performance, and economy of the gas centrifuge machines that will be accomplished through the Lead Cascade.

The purpose of the applicant's proposal is to provide the necessary technical information to assist in determining whether the advanced uranium enrichment technology being developed at the ETTP in Oak Ridge, Tennessee, under a CRADA will support proceeding with the Commercial Plant as mandated by the DOE-USEC Agreement. The Lead Cascade at PORTS is an important intermediate step of this process toward advancing the Commercial Plant. The Lead Cascade will evaluate the gaseous centrifuge uranium enrichment technology that DOE previously developed to support the national energy security goals.

Currently, the USEC Inc., through its subsidiary, produces about 5 million SWU per year using gaseous diffusion technology at the PGDP. The PGDP is over 50 years old, and the electrical costs to produce SWU are significant. In addition, the United States Enrichment Corporation is introducing into the market about 5 million SWU per year of LEU that is derived from the downblending of HEU from dismantled Russian nuclear weapons. The agreement under which USEC Inc. supplies LEU from this source expires in 2013. Global LEU suppliers compete primarily in terms of price and secondarily in terms of reliability of supply and customer service. Hence, due to the age of the PGDP, the cost of electricity, and the currently scheduled expiration of the HEU agreement, USEC Inc. needs to deploy a lower cost and domestically available advanced uranium enrichment technology towards the end of this decade (USEC, 2003a).

1.6 Relevant NRC Regulations

The Lead Cascade must comply with the principal regulations under the *Atomic Energy Act of 1954*, as amended; 10 CFR Part 40; and 10 CFR Part 70 to hold a license to possess and use source and special nuclear materials. In addition, the Lead Cascade must comply with pertinent NRC regulations given in 10 CFR Part 20 related to radiation dose limits to individual workers and members of the public. USEC Inc. submitted an environmental report to the NRC in accordance with 10 CFR Part 51. In addition to these regulations, PORTS is currently operating in accordance with an NRC CoC issued under 10 CFR Part 76.

In addition, the United States Enrichment Corporation possesses a license from the State of Ohio for radioactive material operations (the Ohio Nuclear Materials Safety Program licenses all handlers of radioactive materials not under the jurisdiction of the Federal Government) (Ohio, 2002). USEC Inc. will apply to the Ohio Nuclear Safety Program for any additional licenses that would be required to possess and to use byproduct materials (e.g., calibration sources).

1.7 References

State of Ohio (Ohio, 2002). “Ohio Department of Health: Department of Nuclear Safety.” September 27, 2002. <http://www.odh.state.oh.us/ODHPrograms/NM_SAF/nm_saf1.htm> (31 October 2003).

U.S. Department of Energy (DOE, 1976). “Final Environmental Statement – Expansion of U.S. Uranium Enrichment Capacity.” ERDA-1543, Energy Research and Development Administration. April 1976.

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– – – (DOE, 2003). “Additions to Preliminary Draft Environmental Assessment (EA) for the USEC Proposed American Centrifuge Lead Cascade Facility at the Portsmouth, Ohio Gaseous Diffusion Plant Site Reflecting Initial Clean-out of Abandoned 1980's Vintage Centrifuge Machines.” Oak Ridge Operations. October 16, 2003.

USEC Inc. (USEC, 2003a). “Environmental Report for American Centrifuge Lead Cascade Facility at USEC’s Facilities in Piketon, Ohio.” LA-2605-0002. February 2003.

USEC Inc. (USEC, 2003b). “License Application for American Centrifuge Lead Cascade Facility at USEC’s Facilities in Piketon, Ohio.” LA-2605-0001. February 2003.

USEC Inc. (USEC, 2003c). “USEC/NRC License Application Meeting Regarding the American Centrifuge Lead Cascade Facility.” Presentation to the U.S. Nuclear Regulatory Commission. February 25, 2003.

2 PROPOSED ACTION AND ALTERNATIVES

This section presents the proposed action and alternatives that are considered in this Environmental Assessment (EA) including the no-action alternative as required by the *National Environmental Policy Act* (NEPA). The description identifies the planned activities and facilities, the location of the proposed action or alternative, and the duration of the activities.

2.1 The Proposed Action

The proposed action calls for the U.S. Nuclear Regulatory Commission (NRC) to issue a license to USEC Inc. to possess and use special nuclear material in the American Centrifuge Lead Cascade Facility (Lead Cascade) at the U.S. Department of Energy's (DOE's) Portsmouth Gaseous Diffusion Plant (PORTS) reservation located in Piketon, Ohio. The proposed action will not impact the ongoing environmental restoration activities at PORTS.

2.1.1 Process Description

USEC Inc. is proposing to construct and operate the Lead Cascade at PORTS. The Lead Cascade will operate up to 240 gaseous centrifuges (Figure 2-1) in the recycle mode as a "closed loop" system. Recycle mode is where the enriched product stream is recombined with the depleted stream prior to being reintroduced to the cascade forming a continuous closed, or sealed, loop of uranium hexafluoride (UF_6) (USEC, 2003c). In addition to the 240 full-scale gaseous centrifuges, USEC Inc. may secure additional gaseous centrifuges as spares. The Lead Cascade is operated so that no enriched material (other than samples) is withdrawn.

The Lead Cascade system may process up to 250 kilograms (kg) of UF_6 and enrich uranium up to 10 weight percent uranium-235 (^{235}U), although most enrichment will be less than 5 weight percent. Repair and maintenance operations may be conducted with equipment contaminated with uranium-bearing material such as UF_6, uranium tetrafluoride (UF_4), uranyl fluoride (UO_2F_2), or an intermediate oxy-fluoride (USEC, 2003a and 2003c).

The gas centrifuge machine consists of a large rotating cylinder and piping for the feeding of the UF_6 gas and the withdrawal of depleted and enriched UF_6 gas streams.

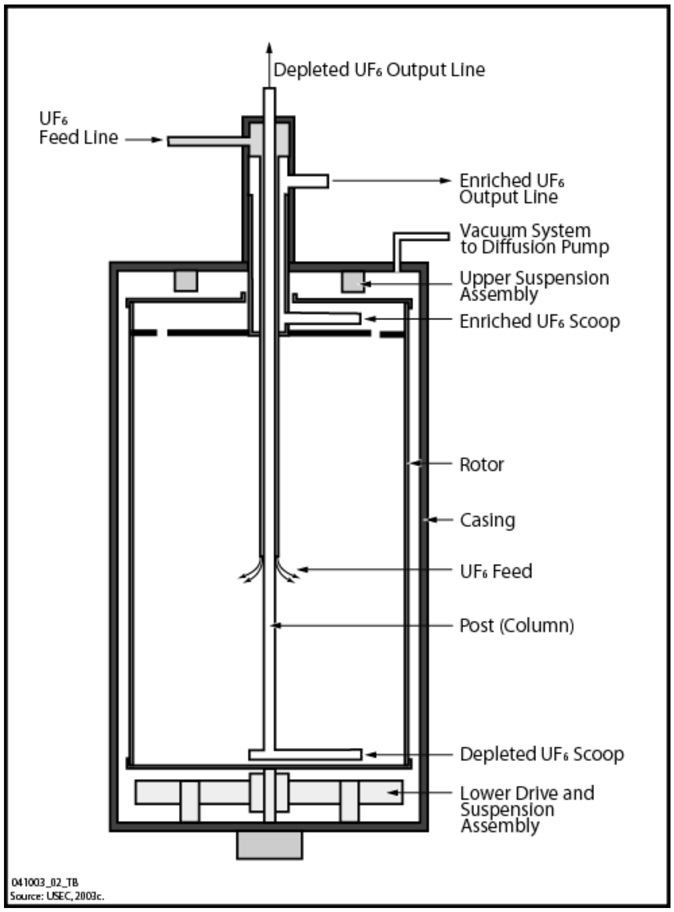

Figure 2-1 Schematic of a Gas Centrifuge

The rotating cylinder (rotor) is contained within another cylinder (casing) that maintains the rotor in a vacuum and provides physical containment of components in the unlikely event of a catastrophic failure of the gas centrifuge machine. Other major components of a gas centrifuge include upper and lower suspension systems, and a motor and control system (USEC, 2003c).

For an operating centrifuge, UF_6 gas is fed into the rotor that is spinning at relatively high rotational velocities. The heavier $^{238}UF_6$ isotope accumulates at the rotor wall, whereas the lighter $^{235}UF_6$ isotope accumulates more toward the center (pushed away from the wall by the $^{238}UF_6$ isotopes). A slight axial (counter current) flow, induced by mechanical and/or thermal agitation, carries the $^{238}UF_6$ downward along the wall and the $^{235}UF_6$ upward along the axis. As the gas travels up the axis of the centrifuge, it is constantly being depleted of $^{238}UF_6$ and enriched in $^{235}UF_6$. The length of the centrifuge and the velocity of the gas impacts the gas centrifuge machine's separative capacity. The combined effect of the radial gradient and axial flow enables a relatively significant assay gradient to develop between the bottom and the top of the centrifuge (USEC, 2003c).

The separation capacity of a centrifuge is the function of two phenomena — the radial separation and the axial separation. Radial separation (separation factor) is created by centrifugal force. Axial separation is created by the net transport of $^{235}UF_6$ to the top and $^{238}UF_6$ to the bottom of the centrifuge. The separation factor of the centrifuge process is an order of magnitude higher than that of the gaseous diffusion process, although neither is much greater than a factor of one. Due to the higher separation factor of the centrifuge process, there are also orders of magnitude fewer stages required in a gaseous centrifuge facility than in a gaseous diffusion plant (USEC, 2003c).

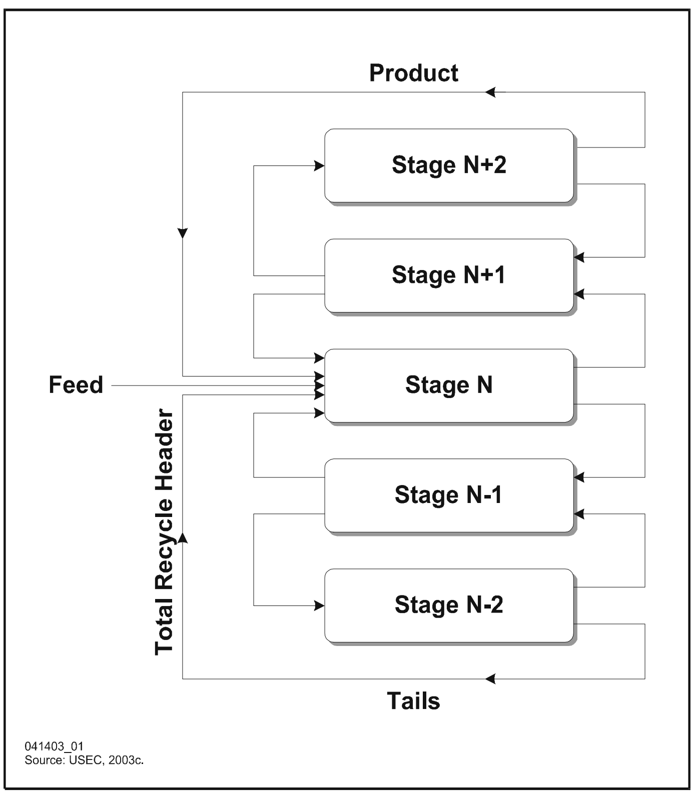

Figure 2-2 Process Configuration

For a cascade facility, separating elements are connected in series, called stages, to achieve the desired assay of ^{235}U enrichment. Many separating elements are also connected in parallel in the centrifuge process to achieve the desired mass flows forming a cascade. Figure 2-2 schematically presents a cascade and multiple stage configuration and the flow arrangement between stages. Through this configuration, natural feed enters the cascade at the middle of the configuration with the product streams being enriched in ^{235}U to the top and the tails streams being depleted of ^{235}U to the bottom (USEC, 2003c).

A diffusion pump produces the required vacuum between the rotor and casing of each gas centrifuge. A purge vacuum (PV) system maintains a suitably low pressure for efficient operation of the diffusion pumps. The output of the diffusion pumps discharges to the PV system. Any UF_6 and light gases that may escape from the rotor and any light gases entering the vacuum system due to in-leakage are removed. The main sources of gases to be removed are air in-leakage, hydrogen fluoride (HF) that originates from the cascade feed and from the reaction of UF_6 and moisture from air in-leakage, UF_6 leakage into the centrifuge casing vacuum, and residual inert gas (USEC, 2003c).

The evacuation vacuum (EV) pump system, which interfaces with the PV system at the diffusion pump and at the chemical traps, shares with the PV system the chemical traps, the exhaust gas analyzer, and the building vent piping to the outside environment. A manual interlock prevents the centrifuge from being valved into the EV and PV systems simultaneously. The purpose of the EV system is to reduce the casing pressure of newly installed or replacement centrifuges from atmospheric pressure to a sufficiently low value that ensures the centrifuge casing can be connected to the PV system without upsetting PV system operation. The EV system also evacuates the service module process headers (USEC, 2003c).

The PV and EV systems are monitored to ensure proper operation of chemical traps to minimize potential releases of radionuclides. The EV system has the capability to bypass the chemical traps during initial start-up and to pump down service modules, piping, and new machines prior to gas introduction (USEC, 2003c).

The machine cooling water (MCW) system services the EV and PV vacuum pumps by providing cooling water. This system contains circulating water pumps, filter, heat exchanger, an expansion tank, and a piping tie-in to the chemical feed, deionizer, and sanitary water systems. Water treatment chemicals are used to maintain cooling water chemistry. An alarm system is used to monitor water levels and makeup (USEC, 2003c).

The Process Area Ventilation System provides circulation of air and maintains a positive pressure with respect to the outside ambient atmospheric pressure in Building X-3001. This reduces the infiltration of dirty and/or cold air. Each ventilation unit consists of a supply fan, a return/exhaust fan, filters and associated ductwork with automatic dampers, and controls. Outside air is used to cool the process building, and no heating coils are provided in the system. The system can also be used for smoke removal in the event of a fire in X-3001.

The Process Area Heating and Pressurization System provides heating for the process area. Each of these units is made up of a pneumatically operated outside air intake damper, a return air damper, a filter section, a heating coil section, a supply fan, and distribution ducts (USEC, 2003c).

Small quantities of hazardous materials are currently stored in the Lead Cascade facilities. These materials include acetone, solvents, and oils that are used for assembly and maintenance activities. These materials are annually reported to the Federal and State Environmental Protection Agencies as required by the *Superfund Amendments Reauthorization Act* (SARA) (USEC, 2003c).

2.1.2 Scope of the EA

The goal of the proposed action is to generate reliability, performance, and cost information and provide other vital data to support decisions concerning the deployment of a Commercial Plant. The Lead Cascade will be located in existing facilities that will be leased from DOE. While coordination with DOE will be necessary in the cleanout of the existing Gas Centrifuge Enrichment Plant (GCEP) facilities to prepare for the USEC Lead Cascade Project, there are no overall major impacts of this proposed action to the ongoing missions at the site (DOE, 2003).

The proposed action includes the following seven distinct activities. These identifiable activities will take place at PORTS with the exception of items 2 and 3. These items below were analyzed and presented in another NEPA document, DOE/EA-1451, *Environmental Assessment for the Leasing of Facilities and Equipment to USEC Inc.*(DOE, 2002). Chapter 4 of this EA will address the potential impacts associated with these activities.

1. Refurbishment of the facilities at PORTS.
2. Manufacture of the gas centrifuges at Oak Ridge.
3. Transportation of the gas centrifuges to PORTS.
4. Installation and startup of the Lead Cascade.
5. Operation of the Lead Cascade over a 5-year period.
6. Repair and maintenance of the Lead Cascade.
7. Decontamination and decommissioning (D&D).

It should be noted that the facilities to be refurbished are existing DOE buildings that will be leased to USEC Inc. Refurbishment will include removal of existing machines from the previous gas centrifuge facility, partial closure of a *Resource Conservation and Recovery Act* of 1976 (RCRA) Part B permitted facility controlled by DOE, relocation of existing office space, and movement of materials and waste currently stored by DOE in the areas where the Lead Cascade will be located.

USEC Inc. plans to refurbish the following facilities for the Lead Cascade operation (USEC, 2003c):

- X-7726 Centrifuge Training and Test Facility. This 2,787 square meter (m^2) (30,000 square foot [ft^2]) building will be used to receive, inspect, and test material and components; assemble components into the final gas centrifuge machines; leak-check and evacuate the centrifuges; and repair the centrifuges. This building houses an overhead crane to move the centrifuges and other large components. The facility provides storage space for material and components, and also contains an electrical substation and backup generator.

- X-7725 Recycle/Assembly Building. USEC Inc. will lease portions on the west side of this building from DOE to allow either temporary storage or movement of completed gas centrifuge machines by overhead crane from the adjoining X-7726 to a ground-level transporter for storage or final movement to the Lead Cascade. Other leased portions of this building will include a maintenance shop and battery charging area for the transporter, administrative offices, lockers, change rooms, break rooms, and a training room.

- X-7727H Transfer Corridor. This corridor provides an enclosed throughway from the X-7725 to the X-3001 process building. This environmentally controlled corridor is approximately 9 m (30 ft) wide by 244 m (800 ft) long with double doors at each end to enable temperature control between facilities.

- X-3001 Process Building. This building will house the Lead Cascade. Up to 1,381 centrifuges associated with the old centrifuge enrichment facility from the 1980s will be removed (see section 2.1.3 below). A rigid mast crane will be used to move the centrifuges from the transporter to a cascade position. A dump cart is provided to remove the contents of the cascade should inventory need to be reduced for normal operations or as a result of off-normal or accident conditions. A local control center at the cascade provides operator interface, and a mezzanine is used to house heating and ventilating equipment, cooling water pumps, vacuum pumps, and electrical switchgear. In addition, a building vent for the purge and evacuation vacuum systems is located in the process building to remove any gas that enters the space between the internal rotor and casing of a centrifuge.

- X-3012 Process Support Building. This building is located on the east side of the process building and will house the control room, maintenance shops and stores, offices, locker rooms, and a lunchroom. A high bay transfer corridor separates the process support building into operations and maintenance functions.

- Other Support Facilities. These facilities will include the Waste Management Staging Facility (XT-847 Building) and the Technical Services Facility (X-710 Building). The Waste Management Staging Facility is located near the southern end of PORTS and is used to accumulate and stage/prepare radioactive waste and nonhazardous recyclable materials for shipment offsite that may be generated by the Lead Cascade. The Technical Services Facility contains an analytical laboratory that will be used to perform chemical and isotopic analyses for the Lead Cascade.

Various activities potentially need to be performed prior to turning over the existing facilities to USEC Inc. to begin Lead Cascade upgrade activities. These activities include preliminary facility repairs and modifications; partial relocation of DOE operations; partial or complete cleanout and disposal of material from the X-3001 GCEP Process Building (e.g., old centrifuges/equipment/parts, classified material, records, miscellaneous equipment); enclosure of the X-3002 Heating Plant; disposition of hazardous waste stored in certain areas of X-7725; and subsequent modification of the RCRA Part B permit to reflect the new storage area.

New centrifuges and related components will be manufactured at the ETTP in Oak Ridge, Tennessee, and transported by truck to PORTS for installation in the Lead Cascade. The manufacture and transportation of the components are analyzed in a separate EA, developed by DOE, in which no significant impacts were found (DOE, 2002).

2.1.3 Waste Generation and Management

The operation of the Lead Cascade will generate air effluents, liquid effluents, hazardous materials, and radioactive solid waste. Air effluents will consist of HF, UF_6 (approximately 2.1×10^{-16} μCi/mL total uranium at the boundary), and residual inert gas. Air effluents will be filtered through the PV or EV system (USEC, 2003a).

Liquid wastes to be generated by the Lead Cascade consist of sanitary wastewater and cooling water. Sanitary wastewater will be treated by the currently operational X-6619 Sewage Treatment Plant. Cooling water will be recycled and will not normally be released. Spills and leaks of cooling water will be collected by floor drains and underground collection tanks as part of the Liquid Effluent Collection (LEC) System and treated at either the X-6619 Sewage Treatment Plant or containerized for disposal, depending on analytical results of the effluent in the LEC. Liquid effluents generated by the Lead Cascade will not make a quantifiable difference in existing discharge levels (USEC, 2003a).

Refurbishment (including facility cleanout and turnover activities) and operational activities will generate solid sanitary/industrial waste, low-level radioactive waste (LLRW), mixed waste, nonregulated solid wastes, and RCRA waste. Some of the cleanout material may also be classified. Table 2-1 presents estimates of the source and quantity of annual waste generation.

As part of the facility cleanout activities, nonclassified material currently located in the south half of the X-3001 Building will have to be either relocated or disposed. Unclassified records and material in the north half of the X-3001 Building will have to be relocated. If not relocated to other temporary storage within the complex, tools and fixtures will have to be fabricated to support the disassembly of as many as 569 clean (nonradiologically contaminated) and 812 radiologically contaminated centrifuges.

Table 2-1 Projections of Waste Quantities for Major Waste Types

Material/Activity	Type of Waste Generated	Stage of Operation	Projected Annual Rate[a]
Classified components from old centrifuges	Radiological and nonregulated	Refurbishment	9,817 m^3 (346,684 ft^3)[b]
Liquid (oil) waste from old centrifuges	Mixed RCRA	Refurbishment	50,725 L (13,400 gal)[b]
Paper, construction debris, wood, concrete	Sanitary/industrial	Refurbishment	76-114 m^3 (100-150 yd^3)
Paper, office waste, bathroom supplies	Sanitary/industrial	Refurbishment	38-76 m^3 (50-100 yd^3)
Lubricants, maintenance debris	Nonregulated	Refurbishment and Operations	12-14 m^3 (400-450 ft^3)
Light bulbs and batteries	RCRA recycle	Refurbishment and Operations	3-5 m^3 (100-150 ft^3)
Paper, office waste, bathroom supplies	Sanitary/industrial	Operations	76-114 m^3 (100-150 yd^3)
Refrigerant from withdrawal system	LLRW	Operations	3,032-4,548 L (800-1,200 gal)
Classified Waste	Nonregulated	Operations	60-90 m^3 (2,000-3,000 ft^3)
Classified Waste	LLRW	Operations	60-90 m^3 (2,000-3,000 ft^3)
General maintenance and facility materials	Mixed RCRA/LLRW	Operations	6-12 m^3 (200-400 ft^3)
General maintenance and facility materials	RCRA	Operations	18-30 m^3 (600-1,000 ft^3)
General maintenance and facility materials	LLRW	Operations	18-30 m^3 (600-1,000 ft^3)
General maintenance and facility materials	Nonregulated	Operations	30-54 m^3 (1,000-1,800 ft^3)
Polychlorinated Biphenyls (PCB) waste	TSCA		None projected
Asbestos waste	TSCA		None projected

[a] The projected annual rate is based on 12 centrifuge machines, scaling up to 240 machines.

[b] Total, not annual waste generated.

Source: USEC, 2003a and DOE, 2003.

This disassembly operation would include removal of hazardous materials/fluids, declassification of certain disassembled components, and volume reduction of remaining classified components. Volume-reduced classified components (approximately 9,817 m^3 or 346,684 ft^3) will be packaged in drums/boxes, loaded into Sea Land containers, shipped, and disposed in an authorized classified contaminated disposal facility. Noncontaminated and declassified reusable components will be made available for resale. Disposal of liquid waste (approximately 50,725 liters or 13,400 gallons of oil) removed during component disassembly will be at an authorized RCRA treatment, storage, and disposal facility. The cleanout and material disposal effort would be spread over a three- to four-year period.

USEC Inc. estimates approximately five shipments per year of RCRA waste and five shipments per year of the LLRW/MW will be made offsite that are associated with Lead Cascade operations (USEC, 2003e).

2.1.4 Decontamination and Decommissioning

If the follow-on Commercial Plant is sited at PORTS, then the Lead Cascade facility will undergo D&D when the Commercial Plant is decommissioned. If the Commercial Plant is sited at the PGDP site, then the Lead Cascade will undergo D&D upon the conclusion of Lead Cascade operations. As part of D&D, all service modules, process headers, vacuum pumps, and traps will be cleaned, evacuated, purged, and removed. In particular, gas centrifuges will be processed by removing the external fittings, bottom flange, motor and bearings, and collection of contaminated oil; removing the top flange and withdrawing and disassembling internals; and destroying classified parts by shredding, crushing, or burial. Only the building shells and facility infrastructure (including equipment that existed at the time of the lease with DOE) will remain. All facilities used for the Lead Cascade will be decontaminated based on the requirements of the lease. Radioactive and hazardous wastes will be treated and/or disposed at licensed facilities. At the conclusion of D&D, the facilities will be de-leased and returned to DOE (USEC, 2003c).

Approximately 204 man-months will be required throughout the 12-month decommissioning effort. The total number of personnel required to complete each of the four phases of decommissioning will fluctuate throughout the decommissioning process. In addition to the manpower required for the decommissioning effort, approximately 66 man-months will be required for the core management team of the Lead Cascade (USEC, 2003b).

Personnel doses are anticipated to be less than USEC's Administrative Control Level (ACL) of 500 mrem total effective dose equivalent (TEDE). For air emissions, radiological impacts are estimated to be well below 100 mrem/year as established by the NRC in 10 CFR 20.1301; and 10 mrem/year as established by the EPA in 40 CFR Part 61 and by the NRC in 10 CFR 20.1101(d) as part of the radiation protection principle of "as low as is reasonably achievable" (ALARA).

The primary hazard during D&D is the chemical toxicity of soluble uranium due to an inadvertent release of UF_6. Due to the small source term of UF_6, however, offsite doses will be minimal. More than 80 percent of the radioactive material will be removed from the Lead Cascade upon completion of the demonstration during shutdown and gas/liquid evacuation from the equipment/components. Remaining radioactivity will have to be removed via decontamination techniques or disposed as part of the radioactive waste. Isotopes expected to be present during D&D include ^{238}U, ^{235}U, ^{234}U, and their daughter products. The primary contaminant will be small amounts of UO_2F_2, with smaller amounts of UF_4 and other uranium compounds. Decontamination activities will primarily be conducted in a Decontamination Service Area located on the south side of the X-3001 Process Building. Decontaminated components may be reused in the Commercial Plant, but the D&D evaluation assumes the components will be decontaminated in accordance with radiation protection requirements, and classified parts will be dispositioned in accordance with the Lead Cascade Security Program.

Approximately 2,600 m^3 (91,818 ft^3) of radioactive waste will be dispositioned prior to any volume-reduction activities. Table 2-2 summarizes the estimated equipment/components and related volume that will be generated during D&D activities (USEC, 2003c).

Table 2-2 Items for Potential D&D

Equipment and Components	Description	Estimated Quantity
Centrifuges	Casings, rotor assemblies, motors, suspensions, mounts	240 units
Piping	Up to 1-inch diameter process piping (length)	12,000 m (40,000 ft)
	Between 1-inch and 4-inch diameter process piping (length)	1,000 m (3,000 ft)
Pumps	Evacuation vacuum pumps	2
	Purge vacuum pumps	4
Ventilation	3x4 ft Ductwork (length)	100 m (300 ft)
Building Surfaces	Floors in the X-3001 Building	4,050 m^2 (45,000 ft^2)
Valves	Miscellaneous valves	40
Traps	Chemical traps (2 sets of 4)	8
Other Equipment	UF_6 Portable Carts	4
	Centrifuge transporter	1
	Centrifuge manipulator	2
	Centrifuge dismantling equipment	4
Decontamination Service Area	Cutting machines	2
	Degreasers	2
	Decontamination tanks	3
	Wet blast cabinet	1
	Crusher	1

Source: USEC, 2003a; USEC, 2003e.

Contaminated portions of the buildings will be decontaminated as required by the DOE-USEC Agreement. Structural contamination should be limited to areas inside the Contamination Control Zones of the facility. Surveys will be conducted to verify that decontamination outside the zone is not required. A final radiation survey will be performed in accordance with the Lease Agreement requirements. A map of the survey site showing measurements results will be generated. If results show radioactivity limits are still exceeded, then further decontamination will be performed (USEC, 2003c). The D&D process is anticipated to take slightly longer than one year. USEC Inc. does not plan on long-term storage and monitoring of wastes at the facility. According to the license application, the total cost of D&D of the Lead Cascade is estimated to be $6.95 million and includes a 25 percent contingency. This cost estimate includes planning and preparation, NRC review, decontamination and removal activities, restoration of contaminated areas, waste disposition, and a final survey. The cost estimate does not include any offsets related to the resale of unclassified equipment and components (USEC, 2003c).

2.2 Alternatives to the Proposed Action

2.2.1 No-Action Alternative

For the NRC, this alternative involves license denial of the proposed action. For the applicant, this alternative involves not deploying the Lead Cascade demonstration facility. The outcome, however, would be the same. The no-action alternative would decrease the likelihood of deploying the Lead Cascade technology as a full-scale Commercial Plant (USEC, 2003a). Currently, PGDP is the only enrichment facility located in the United States (NRC, 2002) that the Commercial Plant would eventually replace or supplement. In addition, the no-action alternative would require that operations at PGDP continue for USEC to meet its contractual obligations, with a consequence of incurring higher costs.

A gaseous diffusion process is used at PGDP to enrich uranium. In the gaseous diffusion enrichment plant, the solid uranium hexafluoride (UF_6) from the conversion process is heated in its container until it becomes a liquid. The container becomes slightly pressurized as the solid UF_6 heats up and, because the container is not completely full, UF_6 gas then fills the top of the container. The UF_6 gas is slowly fed into the plant's pipelines where it is pumped through special filters called barriers or porous membranes. The holes in the barriers are so small that there is barely enough room for the UF_6 gas molecules to pass through. The isotope enrichment occurs when the lighter UF_6 gas molecules (with the ^{234}U and ^{235}U atoms) tend to diffuse faster through the barriers than the heavier UF_6 gas molecules containing ^{238}U. It takes many hundreds of barriers, one after the other, before the UF_6 gas is enriched with enough ^{235}U to be used in light-water reactors. At the end of the process, the enriched UF_6 gas stream is withdrawn from the pipelines and condensed back into a liquid that is poured into containers. The depleted UF_6 gas stream is also withdrawn and condensed into a liquid in separate containers. Both liquid forms of UF_6 (depleted and enriched) are then allowed to cool and solidify (NRC, 2002).

The gaseous diffusion process requires significantly more electricity than a full-scale Commercial Plant. For a 3.5 million separative work unit (SWU) plant, the current gaseous diffusion technology uses approximately 1,000 megawatt (MW) of electricity as compared to an estimated 84 MW for the gaseous centrifuge technology in the Commercial Plant (Goodyear, 1982). The electrical supply necessary to operate the gaseous diffusion process at PGDP is provided by two coal-fired electrical plants routed through four switchyards. If the no-action alternative is pursued, then USEC Inc. must continue to rely upon the existing gaseous diffusion process with no possibility of a more efficient uranium enrichment process for many years. For this reason, the environmental impacts resulting from power generation for the PGDP operations are greater than the power generation impacts that would be related to Commercial Plant operations.

2.2.2 Alternatives Considered but Eliminated

USEC Inc. considered four additional alternatives, but these alternatives are eliminated from further consideration and analyses. These alternatives are considered as unfeasible and unreasonable in terms of the NEPA requirements (USEC, 2003a) and were eliminated from further analyses due to environmental issues, cost and schedule implications, socioeconomics and community support, technical maturity, and/or operational risks. The specific reasons for the elimination of each alternative are discussed below.

Table 2-3 summarizes all of the alternatives and highlights the reasons for elimination from further consideration.

Table 2-3 Alternatives Considered with Reasons for Elimination

Alternatives	**Reasons for Elimination**			
	Environmental Impacts	Cost and Schedule	Socioeconomics and Community Support	Technical and Operational Risks
Lead Cascade at PGDP		●		
Full-Scale Commercial Plant without Lead Cascade Facility		●		●
Use of Alternative Technology (SILEX)		●		●
Green Field Site for the Lead Cascade	●	●	●	

2.2.2.1 Location of Lead Cascade at Paducah Gaseous Diffusion Plant

This alternative involves constructing and operating the Lead Cascade demonstration facility at PGDP instead of PORTS. USEC Inc. analyzed environmental impacts; cost and schedule; socioeconomics and community support; and technical and operational risks. This analysis showed that environmental impacts are negligibly different compared to the proposed action. USEC Inc. would be required to construct new facilities and supporting infrastructure at PGDP to house the Lead Cascade. The increased costs and extension of the construction time associated with this alternative makes it less favorable than the proposed action (USEC, 2003a).

2.2.2.2 Construct and Operate a Full-Scale Commercial Plant Without the Lead Cascade

For this alternative, a Commercial Plant will be constructed without first constructing and operating a Lead Cascade demonstration facility. Significant technical, financial, and regulatory risks are associated with this alternative. USEC Inc. plans on using centrifuge technology that has been upgraded since early DOE designs that were developed in the early 1980s. USEC Inc. would like to test and validate the advances in materials and manufacturing since that time. USEC Inc. indicated that it must confirm technical performance and reliability before use of a commercial scale plant to reduce the risks to an acceptable level (USEC, 2003a).

2.2.2.3 Use of Alternative Enrichment Technologies

The SILEX (Separation of Isotopes by Laser Excitation) technology was the one other technology being pursued by USEC Inc. under a licensing agreement with the Silex Systems Limited company of Australia. SILEX is in the second stage of a three-stage development program and requires additional research and development (Silex, 2003). SILEX is a relatively premature technology for full-scale commercial usage whereas the use of centrifuges for uranium enrichment is a proven technology approach. Deploying SILEX would require delaying the construction and operation of a Commercial Plant, increasing environmental impacts due to the continued operation of the gaseous diffusion plant at PGDP (USEC, 2003a). USEC Inc. has discontinued its funding for research and development of SILEX because “it is unlikely that the SILEX technology can be utilized to meet USEC Inc.’s needs and it would not be a prudent investment...” (USEC, 2003d).

2.2.2.4 Construction and Operation at a “Green Field” Site for the Lead Cascade

According to the applicant’s ER, the alternative of building the Lead Cascade at a nonindustrial site not owned by DOE (i.e., a “green field” site) was eliminated due to significant cost and schedule disadvantages as compared to the proposed action. Environmental data would have to be developed for a new site. In addition, a green field site would also have to be purchased or leased, meet the socioeconomic criteria, and have community support. Available skilled labor would have to be found near or relocated to the green field site. Since the proposed action uses an existing industrial facility with a skilled labor force, the environmental impacts at a green field site will be greater than the proposed action (USEC, 2003a).

2.3 References

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3 AFFECTED ENVIRONMENT

This chapter describes the physical, biological, aesthetic, and cultural aspects of the Portsmouth Gaseous Diffusion Plant (PORTS) reservation site and adjacent areas that could be affected by the American Centrifuge Lead Cascade Facility (or the Lead Cascade).

3.1 Site Location and Facility Description

The PORTS reservation is located in a rural area of Pike County in south central Ohio, east of the Scioto River, about equidistant between Portsmouth and Chillicothe, Ohio.

The PORTS reservation is an industrial site that has been extensively characterized for environmental impacts from past operations. The Perimeter Road surrounds a 486-hectare (ha) (1,200-acre) centrally developed area. The terrain surrounding the reservation, except for the Scioto River floodplain, consists of marginal farmland and densely forested hills. The Scioto River floodplain is farmed extensively, particularly with grain crops.

The reservation land outside Perimeter Road is used for a variety of purposes, including a water treatment plant, holding ponds, sanitary and inert landfills that are now closed, and open and forested buffer areas. The majority of the site improvements associated with the gaseous diffusion plant are located within the 202-ha (500-acre) fenced area. This fenced area contains three large process buildings and auxiliary facilities that are currently leased to the United States Enrichment Corporation, the subsidiary of USEC, Inc. A second largely developed and fenced area covering about 121 ha (300 acres) contains the facilities built for the Gas Centrifuge Enrichment Plant (GCEP). The open spaces are predominately covered with grass and paved roadways, although between 3,000 to 4,000 hybrid poplar trees were planted on the south side of the facility in 2002-2003 as part of a ground-water remediation project. The remaining area within Perimeter Road has been cleared and is essentially level. Controlled access to the reservation is maintained by a security force (DOE, 2001; DOE, 2002c; DOE, 2003a). For the purpose of this proposed action, no new buildings will be constructed.

PORTS currently operates in accordance with a U.S. Nuclear Regulatory Commission (NRC) Certificate of Compliance (CoC) issued pursuant to the *U.S. Code of Federal Regulations* 10 CFR Part 76 requirements. These operations include maintaining PORTS in cold standby status under a contract with the U.S. Department of Energy (DOE), performing uranium deposit removal activities in the cascade facilities, and removing technetium-99 (^{99}Tc) from potentially contaminated uranium feed in accordance with the June 17, 2002, agreement between USEC Inc. and DOE (USEC, 2003a).

In addition, the United States Enrichment Corporation possesses, from the State of Ohio, a license for radioactive material operations. DOE also has ongoing environmental restoration activities in several areas on the reservation using contractors and subcontractors for this work. On the southern end of the PORTS site, the Ohio National Guard maintains an area for the maintenance, reconditioning, and storage of equipment (USEC, 2003b).

3.2 Climate and Air Quality

3.2.1 Climate

PORTS is located in the humid continental climate zone west of the Appalachian Mountains and has weather conditions that vary greatly throughout the year. The mean annual temperature is about 12.7° Celsius (C) (55° Fahrenheit [F]). Average summer and winter temperatures are 22.2° C (72° F) and 0° C (32° F), respectively. Prevailing winds are out of the south-southwest and average 8.05 kilometers per hour (km/h) (5 miles per hour [mph]). The highest monthly average wind speed, 17.7 km/h (11 mph), typically occurs in the spring. Figure 3-1 provides a wind rose for Portsmouth, Ohio. Moisture in the area is predominantly supplied by air moving northward from the Gulf of Mexico. The average amount of precipitation is about 102 centimeter (cm) (40 inches [in]) per year and is usually well distributed throughout the year (DOE, 2001). Occasionally, heavy amounts of rain associated with thunderstorms or low pressure systems will fall in a short period of time (USEC, 2003a). Fall is the driest season. Snowfall averages approximately 52 cm/yr (20 in/yr) (DOE, 2001). Although its occurrence varies from year to year, snowfall is common from November through March.

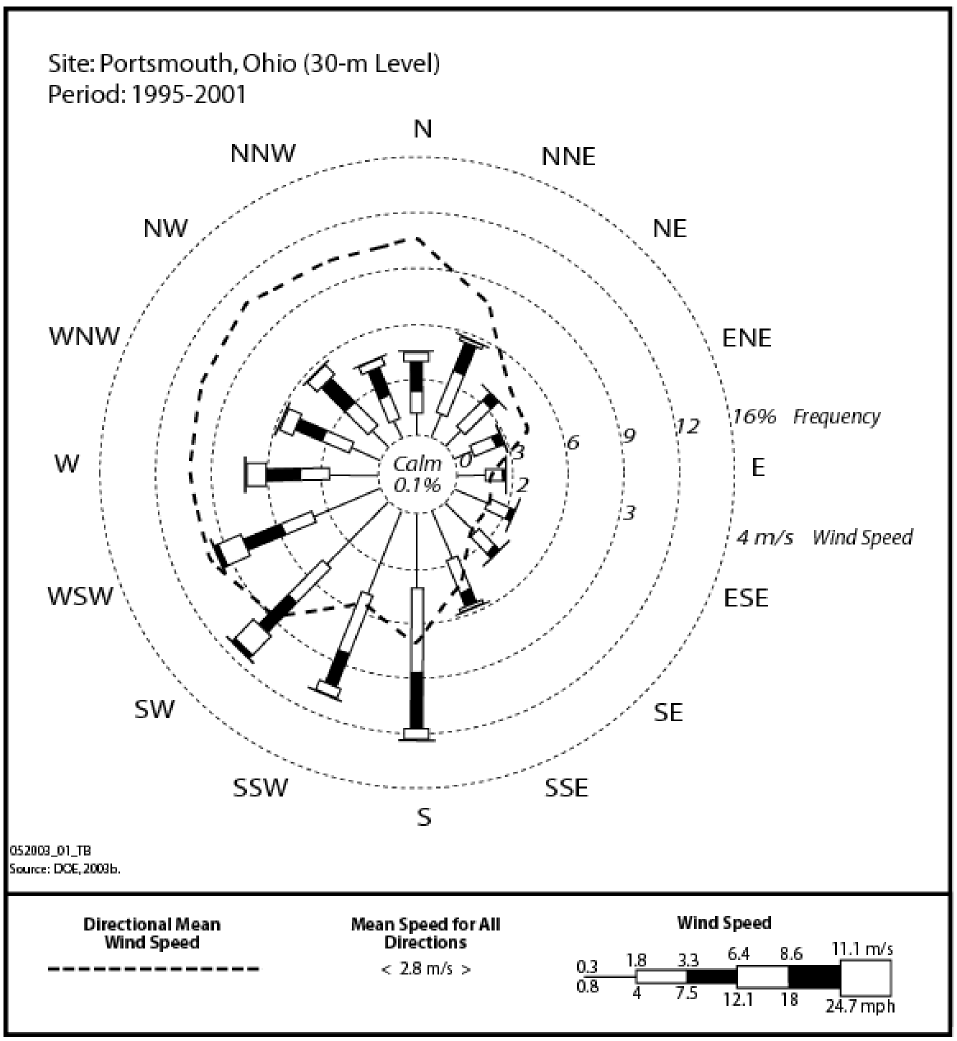

Figure 3-1 Wind Rose for Portsmouth, Ohio

3.2.2 Air Quality

The PORTS region is classified as an attainment area for the pollutants listed in the National Ambient Air Quality Standards (NAAQS). Table 3-1 shows these standards. Primary standards protect against adverse health effects, while secondary standards protect against welfare effects such as damage to crops, vegetation, and buildings. The State of Ohio has adopted the NAAQS and regulations to guide the evaluation of hazardous air pollutants and toxins to specify permissible short- and long-term concentrations.

Table 3-1 Air Quality Standards

		NAAQS ($\mu g/m^3$)		Allowable PSD increment ($\mu g/m^3$)[a]	
Pollutant	**Averaging time**	**Primary**	**Secondary**	**Class I**	**Class II**
Sulfur dioxide	3 hours (h)[b]		1,300	25	512
	24 h[b]	365		5	91
	Annual	80		2	20
Nitrogen dioxide	Annual	100	100	2.5	25
Ozone	1 h[c]	235	235		
	8 h[d]	157	157		
Carbon monoxide	1 h[b]	10,000			
	8 h[b]	40,000			
PM-10[e]	24 h[c]	150	150	8	30
	Annual	50	50	4	17
PM-2.5[fd]	24 h	65	65		
	Annual	15	15		
Lead	3 months[g]	1.5	1.5		

Note: Where no value is listed, there is no corresponding standard.

a Class I areas are specifically designated areas in which degradation of air quality is severely restricted; Class II areas have a less stringent set of allowable increments.

b Not to be exceeded more than once per year.

c Not to be exceeded more than one day per year on average over 3 years.

d The ozone 8-h standard and the PM-2.5 standards are included for information only. A 1999 Federal court ruling blocked implementation of these standards, which EPA proposed in 1997.

e Particulate matter less than 10 µm in diameter.

f Particulate matter less than 2.5 mm in diameter.

g Calendar quarter.

Source: USEC, 2003a.

PORTS is located in a Class II prevention of significant deterioration (PSD) area. PSD regulations were established to prevent significant deterioration of air quality in areas that already meet the NAAQS. Specific details of PSD are found in 40 CFR 51.166. The EPA has set the NAAQS for several criteria pollutants to protect human health and welfare. These pollutants include particulate matter less than 10 microns in diameter (PM^{10}), sulfur dioxide (SO_2), carbon monoxide (CO), nitrogen dioxide (NO_2), lead (Pb), and ozone (O_3). Nonradiological air quality is identified by the amount of different contaminants in the atmosphere expressed in units of parts per million (ppm) or micrograms per cubic meter ($\mu g/m^3$).

Among other provisions, cumulative increases in SO_2, NO_2, and PM^{10} levels after specified baseline dates must not exceed specified maximum allowable amounts. These allowable increases, also known as increments, are especially stringent in areas designated as Class I areas (e.g., national parks and wilderness areas) where the preservation of clean air is particularly important. All areas not designated as Class I currently are designated as Class II. The nearest Class I PSD area is the Dolly Sods Wilderness Area in West Virginia, which is approximately 280 kilometers (km) (174 miles [mi]) east of PORTS (DOE, 2001).

Airborne discharges of radionuclides from PORTS are regulated under the *Clean Air Act* (CAA) National Emission Standards for Hazardous Air Pollutants (NESHAP). In 1999, the radiological emissions at PORTS from the uranium enrichment process operated by the United States Enrichment Corporation were 0.9 curie (Ci) while emissions from DOE sources were 0.000064 Ci (DOE, 2001). In 2001, the radiological emissions from the United States Enrichment Corporation uranium enrichment process, during cold standby operations, were 0.2 Ci while emissions from DOE sources (i.e., ground-water treatment facilities) were estimated to be 0.00063 Ci (DOE, 2002b).

Nonradiological releases to the atmosphere are permitted under the “Ohio Permit to Operate” regulations. Under these regulations, the Ohio EPA can register small emission sources rather than issue a formal permit. PORTS had 4 permitted and 10 registered air emission sources at the end of 2000. These small sources are for conventional air pollutants such as nitrogen oxides, SO_2, and particulate matter. These emissions are estimated every two years for the Ohio EPA’s biennial emission fee statement. The estimated emissions of SO_2, nitrogen oxides, organic compounds, and particulate matter in 1999 were 13 tons/year. Most of these worst-case emissions resulted from particulate (dust) emissions from the X-734 landfill closure. Worst-case air emissions, excluding this source, are no more than 1.5 tons/year. The largest nonradiological airborne discharges from the United States Enrichment Corporation sources are from the coal-fired boilers at the X-600 steam plant. The boilers are permitted by Ohio EPA with opacity, particulate, and SO_2 limits. Electrostatic precipitators on each of the boilers control opacity and particulate emissions. In addition, the boilers emit nitrogen oxides and carbon monoxide. There are also minor contributions of these pollutants from oil-fired heaters, stationary diesel motors, and mobile sources (e.g., cars and trucks). Other air pollutants emitted from the United States Enrichment Corporation operations include gaseous fluorides, water-treatment chemicals, cleaning solvent vapors, and process coolants (DOE, 2001).

The EPA regulates radioactive emissions under NESHAP regulations (40 CFR Part 61, Subpart H). This emission standard limits emissions of radionuclides to the ambient air from the DOE reservation not to exceed amounts that would cause any member of the public to receive, in any year, an effective dose equivalent (EDE) of 10 millirems per year (mrem/yr) (USEC, 2003a).

DOE collected data from a monitoring network of 14 air samplers in 2001 (DOE, 2002b). Data were collected both onsite at PORTS and in the area surrounding PORTS. The monitoring network is intended to assess whether air emission from PORTS affects air quality in the surrounding area. A background ambient air-monitoring station is located approximately 21 km (13 mi) southwest of the site. The analytical results from air-sampling stations closer to the plant are compared to background measurements (DOE, 2001).

Uranium-233/234 ($^{233/234}U$), uranium-235 (^{235}U), and uranium-238 (^{238}U) were routinely detected at the stations and in most of the samples collected from each station. Uranium-236 (^{236}U) was detected in 1 or 2 samples at 6 of the 14 stations. Americium-241 (^{241}Am) was detected at least once at 10 stations. Neptunium-237 (^{237}Np) was detected in one sample, and plutonium-238 (^{238}Pu) or plutonium-239/240 ($^{239/240}Pu$) was detected in one of the samples collected at three stations. ^{99}Tc was not detected at any of the sampling stations in 2001. Detections of the transuranic radionuclides and ^{236}U were usually near the detection limit for the analytical method (DOE, 2002b).

To confirm that air emissions from PORTS are within regulatory requirements and are not harmful to human health, the ambient air-monitoring data were used to calculate a dose to a hypothetical person living at the monitoring station. The net dose calculation for station A10 is 0.00019 mrem/year, which is well below the 10 mrem/year limit applicable to PORTS (DOE, 2002b).

3.3 Geology, Seismology, and Soils

3.3.1 Geology

PORTS is located within the Appalachian Plateau physiographic province. The uppermost rock units in this region were deposited in an inland sea during the Paleozoic Era. At the end of the Paleozoic Era (230 million years ago), the region was uplifted and gently folded to form a shallow basin that trends parallel to the Appalachian Mountains. Subsequent erosion of the uplifted sediments produced the deeply dissected, knobby terrain that characterizes the region today. The geologic structure of the area is simple and dominated by relatively flat-lying Paleozoic shales and sandstones that are overlain by Pleistocene fluvial and lacustrine deposits (DOE, 1995). The near-surface geologic materials that influence the hydrologic system of the site consist of several bedrock formations and unconsolidated deposits.

The bedrock formations include (from oldest to youngest) Bedford Shale, Berea Sandstone, Sunbury Shale, and Cuyahoga Shale. These formations dip gently to the east-southeast with no known geologic faults that are located in the area; however, joints and fractures are present in the bedrock formations.

The unconsolidated deposits that overlie bedrock are comprised of clay, silt, sand, and gravel, and are classified as the Minford (Clay and Silt members) and the Gallia (Sand and Gravel members) of the Teays formation (DOE, 2001). Prior to the Pleistocene glaciation, the Teays River and its tributaries were the dominant drainage system in Ohio.

The preglacial Portsmouth River, a tributary of the Teays, flowed north across the plant site, cutting down through the Cuyahoga Shale and into the Sunbury Shale and Berea Sandstone, and deposited fluvial silt, sand, and gravel of the Gallia member of the Teays Formation (DOE, 2001). Figure 3-2 illustrates the geologic cross sections in the vicinity of PORTS.

3.3.2 Seismology

The seismicity of the Midwest region, which includes PORTS, is dominated by the New Madrid seismic zone. The four great shocks in the years 1811-1812 were each large enough to produce intensities capable of causing minor damage in the southern Ohio region (e.g., broken windows, fallen plaster). Three historical earthquakes not associated with the New Madrid seismic zone were found capable of producing this level of damage. All but one of the epicenters of these seismic events are at least 100 km (62 mi) from PORTS (USGS, 1997).

The closest known fault to PORTS, the Kentucky River fault zone, is within 40 km (25 mi) of the site, and no seismicity has been recorded on it. Soil testing for the GCEP facility indicated that the potential for earthquake-induced soil liquefaction is relatively low. The potential for soil-structure interaction (ground-motion magnification) is also slight. Pike County is not one of the potential jurisdictions listed in Appendix VI of 40 CFR Part 264 for which compliance with seismic standards must be demonstrated (DOE, 2001).

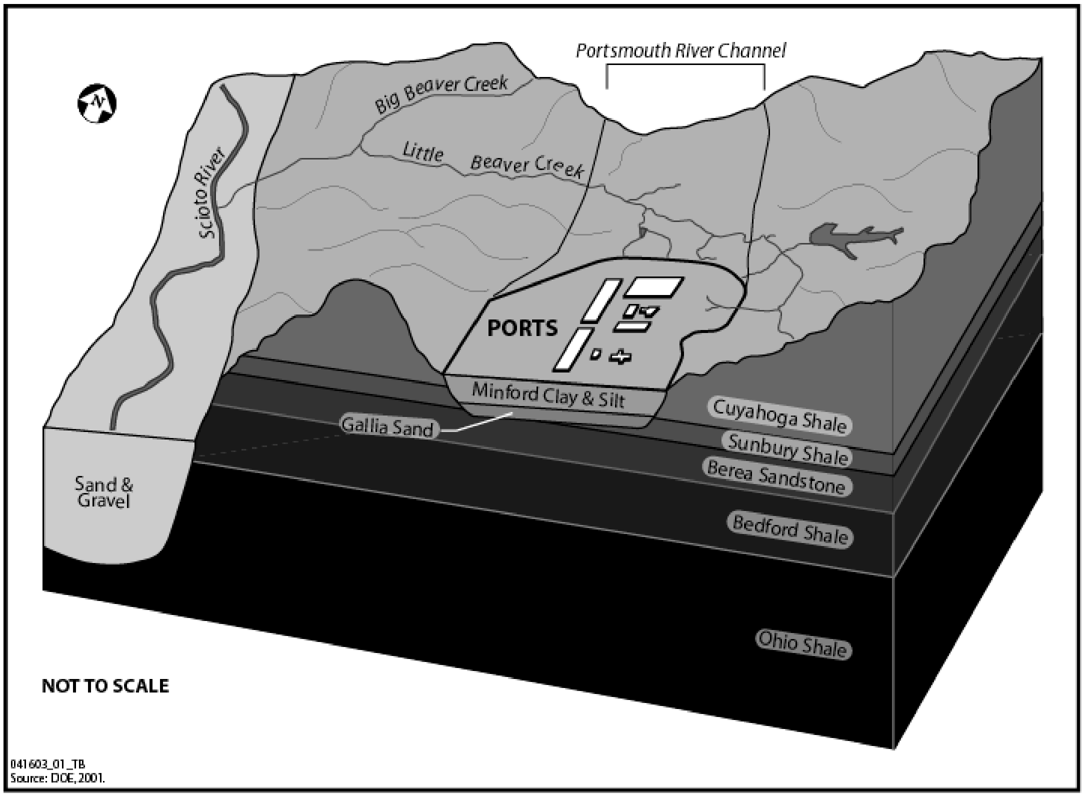

Figure 3-2 Site Geology in the Vicinity of PORTS

3.3.3 Soils

According to the Soil Survey of Pike County, Ohio, 22 soil types occur within the PORTS reservation property boundary with the predominant soil type being Omulga Silt Loam. These soils are well drained and have a surface layer of dark grayish-brown friable silt loam. The underlying soils are approximately 54 in thick and are distinguished by their yellowish-brown, mottled, and friable characteristics. Most of the area within the active portion of the site is classified as Urban land-Omulga complex with a 0- to 6-percent slope that consists of Urban land soils and a deep, nearly level, gently sloping, and moderately well-drained Omulga soil in preglacial valleys. The Urban land is covered by roads, parking lots, buildings, and railroads and is so obscure or altered that soil identification is not feasible (USEC, 2003a).

The Pike County Soil Conservation Service determined that, according to the Soil Survey for Pike County, Ohio, soils within and adjacent to the confines of PORTS are of marginal significance and not prime farmland (i.e., of low fertility as defined by the Soil Survey for Pike County, Ohio) (Borchelt, 2003).

In 2001, soil samples in the process area at 15 sampling locations indicated the following measurable ranges of contamination (DOE, 2002b):

Uranium	2.7-20.4 μg/g
^{99}Tc	0.1-44.3 pCi/g
Beta activity	9.1-91.4 pCi/g
Alpha activity	4.8-56.1 pCi/g

Analytical results for alpha activity, beta activity, and total uranium from the external samples collected near PORTS are not appreciably different from results of samples collected 16.1 km (10 mi) from PORTS. ^{99}Tc was detected at less than 0.5 pCi/g at several offsite soil-sampling locations and at three of the four background sampling locations (DOE, 2002b).

For sediment samples, ^{99}Tc is usually detected in locations downstream from PORTS. In 2001, ^{99}Tc was detected in one or both of the samples collected from downstream sampling locations on Little Beaver Creek. ^{99}Tc was detected in both the upstream and downstream samples collected on Big Beaver Creek and Big Run Creek. ^{99}Tc was also detected in the sediment samples collected at two USEC National Pollutant Discharge Elimination System (NPDES) outfalls. Many of the detections of ^{99}Tc were at, or close to, the detection limit for the analytical method. In general, levels of ^{99}Tc detected in sediment are consistent with results from 1999 and 2000 (DOE, 2002b).

In 2001, at least one sediment sample from each sampling location except downstream Scioto River was analyzed for uranium isotopes ($^{233/234}$U, ^{235}U, ^{236}U, and ^{238}U) and transuranic radionuclides (^{241}Am, ^{237}Np, ^{238}Pu, and $^{239/240}$Pu). The highest concentrations of total uranium were detected at the west background sampling location; however, the highest concentrations of uranium isotopes were usually detected at one of the downstream sampling locations on Little Beaver Creek. These results are consistent with the low levels of ^{99}Tc contamination also detected at these two sampling locations (DOE, 2002b).

3.4 Water Resources

3.4.1 Site Hydrology

The ground-water system at the site includes two water-bearing units (the bedrock Berea Sandstone and the unconsolidated Gallia) and two aquitards (the Sunbury Shale and the unconsolidated Minford). The basal portion of the Minford is generally grouped with the Gallia to form the uppermost and primary aquifer at the facility. The hydraulic properties of these units and ground-water flow at the site have been well defined (USEC, 2003a).

Ground-water recharge and discharge areas include both natural and manmade recharge and discharge areas. Natural recharge to the ground-water flow system at the site comes from precipitation. Land use and the presence of thick upper Minford Clay and the Sunbury Shale effectively reduce recharge to underlying units. Recharge to the Minford and Gallia is reduced because a large percentage of the land is paved or covered by buildings. However, recharge to the Berea Sandstone from the overlying Gallia is increased as a result of the absence of the Sunbury Shale beneath the site (USEC, 2003a).

Ground-water flow at the site is generally divided into four separate flow regions. The Lead Cascade will be located in Quadrant I (X-7726 Centrifuge Training and Test Facility, X-7725 Recycle/Assembly Building, and X-7727H Transfer Corridor) and Quadrant III (X-3001 Process Building and X-3012 Process Support Building) (DOE, 2002a). Ground-water divides provide the basis for separation of the reservation into quadrants. The ground-water divides generally coincide with topographic highs along the center of the industrial complex (from south to north) and topographic highs radiating outward and separating the predominant surface water features draining the facility. The locations of the ground-water flow divides may migrate small distances in response to seasonal changes in precipitation and ground-water recharge. Also, the rates of pumping of the reservation sumps and remediation wells can influence the location of the ground-water divides in some areas (USEC, 2003a).

Ground water at the site discharges primarily to surface streams. Ground water in the eastern and northern portions of the facility discharges to the East and North Drainage Ditches and to the Little

Beaver Creek. In the southern portion of the facility, ground water discharges to the Big Run Creek and to the unnamed Southwest drainage ditch. Along the western boundary of the site, the West Drainage Ditch serves as a local discharge area for all geologic units (USEC, 2003a).

Ground-water recharge and discharge areas at the site are also affected by manmade features including the storm sewer system, the sanitary sewer system, the recirculating cooling water (RCW) system, water lines, and building sumps.

Ground water is used as a domestic, municipal, and industrial water supply in the vicinity of the PORTS reservation. Most municipal and industrial water supplies in Pike County are developed from the Scioto River Valley buried aquifer. Domestic water supplies are obtained from either unconsolidated deposits in preglacial valleys, major tributaries to the Scioto River Valley, or from fractured bedrock encountered during drilling. Ground water in the Berea sandstone and Gallia sand formations that underlie PORTS is not used as a domestic, municipal, or industrial water supply (USEC, 2003a).

The PORTS reservation is the largest industrial user of water in the vicinity and obtains its water from water supply well fields, which are next to the Scioto River south of Piketon. The wells tap the Scioto River Valley buried aquifer. Total ground-water production averages 49,000 cubic meters (m^3) daily (13 million gallons per day [MGD]) for the entire site, including USEC Inc. activities (USEC, 2003a).

In 2000, a combined annual total of approximately 78,400 m^3 (20.7 million gallons per year [gal/yr]) of contaminated ground water was treated through DOE Ground-water Treatment Facilities. Approximately 488 liters (L) (129 gallons [gal]) of trichloroethylene (TCE) were removed from the ground water. All processed water was discharged through NPDES outfalls before exiting the site (USEC, 2003a).

Four NPDES outfalls discharge ground water that is recovered and treated for volatile organic compounds (VOC). These outfalls discharged the following maximum concentrations: trichloroethene (11 μg/L), and 1,2 trans-dichloroethene (<1 μg/L). These maximum discharges are within NPDES compliance limits (DOE, 2002b).

Eleven ground-water monitoring areas exist at PORTS. Three of these areas are within close proximity to the buildings proposed to house the Lead Cascade facilities: the X-749/X-120/Peter Kiewit Landfill Monitoring Area (located just to the south of the Lead Cascade in Quadrant I), the Quadrant I Ground-water Investigative Area/X-749A Classified Materials Disposal Facility (located just to the east of the Lead Cascade), and the former X-616 Chromium Sludge Surface Impoundments Area in Quadrant III (located just to the north of the Lead Cascade) (DOE, 2002b).

Ground-water contamination plumes are associated with the X-749/X-120/Peter Kiewit Landfill Monitoring Area and the Quadrant I Ground-Water Investigative Area/X-749A Classified Materials Disposal Facility. The most extensive and most concentrated constituent is trichloroethene. Other contaminants associated with these two plumes include xylene, vinyl chloride, cobalt, and radionuclides (uranium, ^{99}Tc, and ^{241}Am). Remediation activities are being performed through the *Resource Conservation and Recovery Act* (RCRA) Corrective Action Program (CAP) (DOE, 2002b).

Chromium was a contaminant at the former X-616 Chromium Sludge Surface Impoundments in Quadrant III. These impoundments have undergone remediation and are currently monitored with 16 monitoring wells. Chromium has exceeded the preliminary remediation goal in one well. Low levels of volatile organic compounds have also been detected. This area is being addressed through the RCRA CAP (DOE, 2002b).

3.4.2 Surface Water

PORTS occupies an upland area bordered on the east and west by ridges of low-lying hills that have been deeply eroded by present and past drainage features. The site elevation is 200 meters (m) (670 feet [ft]), which is about 40 m (130 ft) above the normal stage of the Scioto River. Both ground water and surface water at the site are drained by a network of tributaries of the Scioto River. Figure 3-3 shows the surface water features within 3.2 km (2 mi) of the site.

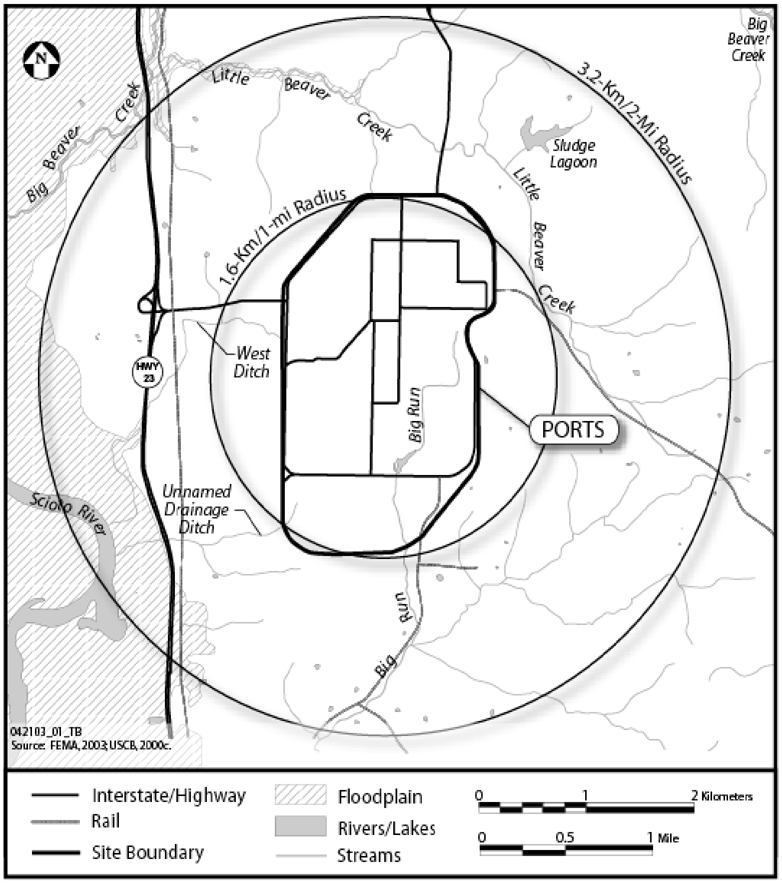

Figure 3-3 Surface Water Features

The Scioto River, approximately 3.2 km (2 mi) west of PORTS, is a tributary of the Ohio River. The two rivers converge approximately 40 km (25 mi) south of the PORTS reservation. Lake White is the only other body of water nearby, located approximately 10 km (6 mi) north of the site. Pike Water, Inc. draws water from the Scioto River for a rural public water supply. The Village of Piketon also utilizes wells along the Scioto River for public water supply (USEC, 2003a).

The site is drained by several small tributaries of the Scioto River, which flow south to the Ohio River. Sources of surface-water drainage include storm-water runoff, ground-water discharge, and effluent from plant processes (USEC, 2003a).

The largest stream on the site is Little Beaver Creek, which drains the northern and northwestern portions of the site before discharging into Big Beaver Creek. Little Beaver Creek is a small, high-gradient, unmodified stream that receives the majority of its flow from East, North, and Northeast Holding Ponds discharges and Ditches (USEC, 2003a).

Big Run Creek, located in the southeastern portion of the site, receives outfall effluent from the South Holding Pond at the headwaters of the stream. Big Run Creek continues southwest from the DOE property line until it discharges into the Scioto River, approximately 6.4 km (4 mi) from the site. The substrates are predominated by gravel and cobble, and the channel has remained unmodified.

In addition, two ditches drain the western and southwestern portions of the site. Their flow is usually low to intermittent. These two drainage ditches continue west and, ultimately, discharge into the Scioto River. Storm water discharges from the proposed Lead Cascade will exit via the unnamed southwest drainage ditch or limited resource water—a designation that indicates a lower-quality habitat. The fauna in limited resource water has been substantially degraded, and recovery is realistically precluded due to natural background conditions or irretrievable human-induced conditions. The Ohio Administrative Code (OAC) has determined the unnamed southwest drainage ditch to be a "small drainage way maintenance" (i.e., a highly modified surface-water drainage way that does not possess the stream morphology and habitat characteristics necessary to support any other aquatic life habitat use). The unnamed southwest drainage ditch is considered suitable for irrigation and livestock watering without treatment, commercial and industrial uses with or without treatment, and partial body contact recreational activities (such as wading) with minimal threat to public health as a result of water quality (USEC, 2003a).

The West Ditch is located on the southwest side of the PORTS site and receives a minimal amount of storm-water runoff from the proposed site for the Lead Cascade. The unnamed southwest drainage ditch and the West Ditch eventually drain into the Scioto River, a warm-water habitat capable of supporting and maintaining a balanced, integrated, adaptive community of warm-water organisms. The water is considered suitable for irrigation and livestock watering without treatment, commercial and industrial uses with or without treatment, and recreational activities (such as swimming, canoeing, and scuba diving) with minimal threat to public health as a result of water quality.

DOE has eight discharge points, or outfalls, through which water is discharged from the site. Three DOE outfalls discharge directly to surface water (i.e., unnamed streams that flow to the Scioto River and Little Beaver Creek); three outfalls discharge to the United States Enrichment Corporation X-6619 Sewage Treatment Plant (STP) before leaving the site through the United States Enrichment Corporation Outfall 003 to the Scioto River; and two outfalls discharge to holding ponds. The United States Enrichment Corporation is responsible for 11 NPDES outfalls at PORTS. Eight NPDES outfalls discharge directly to surface water (i.e., West Drainage Ditch to Scioto River, Little Beaver Creek, Big Run Creek, and the Scioto River); two outfalls discharge to the X-6619 STP (Outfall 003); and one outfall discharges to the X-230K South Holding Pond (Outfall 002) (USEC, 2003a).

The domestic wastewater, generated by the offices and change houses, is treated locally at the PORTS STP, which is currently operating within its NPDES permit. As per the United States Enrichment Corporation NPDES permit, the design capacity of the PORTS STP is 2,275,032 liters per day (L/d) (601,000 gallons per day [GPD]) (USEC, 2003a). As per NPDES monitoring over the previous year, it is currently operating at 27 percent of that capacity. The following maximum contaminant concentrations were measured in the STP discharge in 2001: alpha activity (28 pCi/g), beta activity (229 pCi/g), ^{99}Tc (256 pCi/g), and uranium (18.3 μg/g). All DOE and United States Enrichment Corporation NPDES outfalls remained in compliance with contaminant concentration discharge limits in 2001 (DOE, 2002b).

In 2001, the following levels of uranium and uranium isotopes were detected in surface water at the DOE cylinder storage yards: uranium at 14 μg/L, $^{233/234}$U at 5.2 pCi/L, ^{235}U at 0.21 pCi/L, and ^{238}U at 4.7 pCi/L. The following were not detected in any of the samples collected in 2001: ^{236}U, ^{241}Am, ^{237}Np, ^{238}Pu, and $^{239/240}$Pu. ^{99}Tc was detected in three samples at a maximum concentration of 10 pCi/L (DOE, 2002b). Similar concentrations of radionuclides were detected at upstream and downstream locations on the Scioto River and Big Beaver Creek. Beta activity, ^{99}Tc, and uranium were detected more frequently and at higher concentrations at the downstream sampling locations on Little Beaver Creek than at the upstream sampling location. Uranium was detected more frequently at one of the downstream sampling locations on Big Run Creek than at the upstream sampling location. The maximum detection of ^{99}Tc at any surface-water sampling location in 2001 (43 pCi/L) is below the DOE-derived concentration guide of 100,000 pCi/L for ^{99}Tc in ingested water. Detections of uranium at the downstream sampling locations, while different from concentrations detected upstream, are similar to detections of naturally occurring uranium at the upstream Scioto River sampling location and may be attributable to natural variation (DOE, 2002b).

Samples collected at the surface-water monitoring points in November or December 2001 were also analyzed for isotopic uranium ($^{233/234}U$, ^{235}U, ^{236}U, and ^{238}U) and selected transuranic radionuclides (^{241}Am, ^{237}Np, ^{238}Pu, and $^{239/240}Pu$). None of the transuranics or ^{236}U were detected in the samples. $^{233/234}U$ was detected in 11 of the 14 samples at a maximum concentration of 2.14 pCi/L. ^{235}U was detected only in the sample collected from RW-7 at 0.1594 pCi/L. ^{238}U was detected in 5 of the 14 samples at a maximum concentration of 0.8681 pCi/L in the sample collected from the Scioto River sampling location south of the facility. Each of these detections is well below the DOE-derived concentration guide for the respective uranium isotope in drinking water (500 pCi/L for $^{233/234}U$ and 600 pCi/L for ^{235}U and ^{238}U) (DOE, 2002b).

3.4.3 Floodplains

Floodplains consist of mostly level land along rivers and streams that may be submerged by flood waters. The Flood Insurance Rate Map provided by the Federal Emergency Management Agency (FEMA) indicates that the 100-year flooding is not a problem for the majority of the site. The highest flood level was recorded in January 1913 for the Scioto River in the vicinity of the site. That flood level was 570.0 ft above mean sea level, which is approximately 100 ft below the level of most PORTS facilities (USEC, 2003a).

3.4.4 Wetlands

Wetlands are areas that are inundated or saturated by surface water or ground water. They generally include swamps, marshes, bogs, and similar areas. The area of the proposed action is either inside existing concrete floor buildings or paved; consequently, there are no environmentally sensitive areas within the immediate project area.

In general, the PORTS reservation contains 41 jurisdictional and 4 nonjurisdictional wetlands, totaling 14 ha (34 acres). For the purposes of DOE environmental restoration activities previously performed at PORTS, the site was divided into four quadrants based on ground-water flow patterns. Each quadrant roughly corresponds to a distinct ground-water flow cell within the primary water-bearing unit beneath the site. The majority of the wetlands is associated with wet fields, areas of previous disturbance, drainage ditches, or wet areas along roads and railway tracks (USEC, 2003a).

3.5 Ecology

This section describes the ecological resources including terrestrial resources, wetlands, environmentally sensitive areas, and rare, threatened, and endangered species within the PORTS reservation. The area selected for the Lead Cascade includes existing facilities formerly used for GCEP and located in a fully developed industrial area. As such, the grounds are maintained as lawns and support various species of grasses and herbaceous divots (USEC, 2003a).

3.5.1 Terrestrial Resources

Much of the PORTS reservation and the area in the vicinity of the site has experienced extensive disturbance. There is very little in terms of vegetative communities within the Perimeter Road on the site. The vegetation of surrounding Pike County consists primarily of hardwood forests, and field crops constitute the other major category of vegetative cover in the surrounding area. The habitat types covering the largest area on the reservation are managed grassland, oak hickory forest, and upland mixed hardwood forest (USEC, 2003a).

3.5.2 Wildlife

The area of the proposed action is either inside existing concrete floor buildings or paved; consequently, there is no animal habitat within the immediate project area. Forty-nine species of mammal have been identified in the site area, and the most abundant mammals include the white-footed mouse (*Peromysct£s leucopus*), short-tailed shrew (*Blarina brevicauda*), and opossum (*Dideiphis virginiania*).

One hundred and fourteen bird species including year-round residents, winter residents, and migratory species have been observed onsite. The species include red-tailed hawk (*Buteo amaicensis*), water birds such as the mallard (*Anas platynchos*) and wood duck (*Aix sponsa*), game birds such as wild turkey (*Meleagris gallopavo*), nongame birds such as nuthatches (*Sitta sp.*), and wrens (*Troglodytes sp.*).

Eleven species of reptiles and six species of amphibians have been observed on the site. The most common reptiles include the eastern box turtle (*Terrapene Carolina*), black rat snake (*Elaphe obsolete*), and northern black racer (*Coluber constrictor constrictor*). The most common species of amphibians are the American toad (*Bufo amencanus*) and northern dusky salamander (*Desmognatizus fuscus*).

Common insects include cicadas, aphids, bees, wasps, ants, flies, beetles, and grasshoppers (USEC, 2003a).

3.5.3 Environmentally Sensitive Areas

There are several environmentally sensitive areas within the PORTS reservation. These areas include regions where Ohio-endangered or threatened species have been observed, wetland areas, and the floodplain of the Little Beaver Creek. There are no exceptional water streams within the facility. Discussions of these areas were presented in previous *National Environmental Policy Act* (NEPA) documents (DOE, 2002b, 2003a).

There are no State or national parks, conservation areas, wild and scenic rivers, or other areas of recreational, ecological, scenic, or aesthetic importance within the immediate vicinity of the site (USEC, 2003a).

The area of the proposed Lead Cascade is either inside an existing concrete-floored building or paved and not in proximity to any identifiable environmentally sensitive area at PORTS. Activities associated with the proposed action are not anticipated to impact these areas in any way.

3.5.4 Rare, Threatened, and Endangered Species

To comply with Section 7 of the *Endangered Species Act*, the U.S. Fish and Wildlife Service (USFWS) was contacted to determine if any Federally endangered species may be found at the site. According to the USFWS, the Indiana bat (*Myotis sodalis*) is the only Federally listed endangered animal species whose home range includes the site (Lammers, 2003). Surveys at the reservation revealed no Indiana bats at the site (USEC, 2003a). The Ohio Department of Natural Resources (ODNR) was also contacted, and the ODNR indicates no records of rare or endangered species within the project area (Woischke, 2003).

3.6 Background Radiological and Chemical Characteristics

This section describes the naturally occurring sources of radiation and the levels of exposure that may be found at PORTS.

3.6.1 Average Population Dose

Humans are exposed to ionizing radiation from many sources in the environment. Radioactivity from naturally occurring elements in the environment is present in soil, rocks, and in living organisms. A major proportion of natural background radiation comes from naturally occurring airborne sources, such as radon. These natural radiation sources contribute approximately 300 mrem/yr total to the dose that everyone receives annually.

Manmade sources also contribute to the average amount of dose a member of the U.S. population receives. These sources include x rays for medical purposes (39 mrem/yr), nuclear medicine (14 mrem/yr), and consumer products (5 to 13 mrem/yr) (e.g., smoke detectors). A person living in the United States receives a current average dose of about 360 mrem/yr (NRC, 2002).

3.6.2 Site-Specific Background Chemical and Radiological Characteristics

PORTS has produced high-enriched uranium (HEU) and low-enriched uranium (LEU) using a gaseous diffusion process from the 1950s to the end of production operations in 2001. The enriched uranium is in the form of UF_6. Because of these operations, chemical and radiological contaminants have been released to the air, soils and sediments, surface water, and ground water. All of the chemical and radiological contaminants occur naturally (except plutonium isotopes) or can come from other manmade sources. For this reason, it is necessary to define the background levels of the chemical and radiological constituents to more accurately determine the impact of PORTS operations.

3.6.2.1 Air Concentrations

Table 3-2 summarizes the 2001 background air concentrations based on an air-sampling station specifically located to collect background data. This air-sampling location is located approximately 20.9 km (13 mi) southwest of PORTS.

Table 3-2 Background Air Concentrations

Parameter [a]	Number of Samples [b] (Measurements) [b]	Minimum [c]	Maximum [c]	Average [c,d]
^{241}Am	12 (12)	0	1.5E-05	
Fluoride	52 (8)	1.2E-02	1.9E-01	6.3E-02
^{237}Np	12 (12)	0	5.9E-06	
^{238}Pu	12 (12)	0	1.2E-05	
$^{239/240}Pu$	12 (12)	0	8.0E-06	
^{99}Tc	12 (12)	0	1.9E-03	
Uranium	12 (1)	4.6E-04	1.2E-03	7.5E-04
$^{233/234}U$	12 (0)	1.4E-04	4.6E-04	2.8E-04
^{235}U	12 (6)	0	1.5E-05	
^{236}U	12 (12)	0	6.0E-06	
^{238}U	12 (1)	1.5E-04	3.9E-04	2.5E-04

[a] All parameters are measured in pCi/m^3 with the exception of uranium and fluoride, which are measured in μg/m^3.
[b] Radiological samples are analyzed monthly, samples for fluoride are analyzed weekly. Number in parentheses is the number of samples that were below the detection limit.
[c] Results are provided in scientific notation. The number and sign (+ or -) to the right of the "E" indicate the number of places to the right or left of the decimal point. For example, 3.4E-04 is 0.00034 (the decimal point moves four places to the left); 2.1E+02 is 210 (the decimal point moves two places to the right).
[d] For radionuclides, averages are not calculated for locations that had greater than 15 percent of the results below the detection limit. If the analytical result for a sample was below the detection limit, the ambient air concentration was calculated based on the detection limit for the sample. Averages were calculated for fluoride at all sampling locations.
Source: DOE, 2002b.

3.6.2.2 Sediment Concentrations

Table 3-3 summarizes the 2001 background sediment concentrations. Sampling points are approximately 16 km (10 mi) from PORTS.

Table 3-3 Background Concentrations of Radionuclides and Chemicals in Sediment [a]

Parameter	Unit	RM-10N[b]	RM-10E[b]	RM-10S[b]	RM-10W[b]
Alpha Activity	pCi/g	9.09	4.64U	4U	13
^{241}Am	pCi/g	na	0.05213U	0.02516U	0.03298U
Beta Activity	pCi/g	11.7	9.11	16	16.6
Cadmium	mg/kg	0.597	0.361B	0.601	1.94
Chromium	mg/kg	5.25	4.95	11	8.27
Lead	mg/kg	9.81	9.87	11.7	16.7
Nickel	mg/kg	15.5	5.55	6.68	22.7
PCB, Total	μg/g	1.5U	1.5U	1.5U	1.5U
^{238}Pu	pCi/g	0.01378U	0U	0.006566U	0.01454U
$^{239/240}$Pu	pCi/g	0.00689U	-0.003471U	0.01313U	0.003634U
^{99}Tc	pCi/g	0.0774U	0.062U	2.74	0.144
Uranium	μg/g	3.3	2.7	3.2	5.6
$^{233/234}$U	pCi/g	0.3883	0.3601	0.2616	0.5916
^{235}U	pCi/g	0.03484	0.0287U	0.03157	0.000001019U
^{236}U	pCi/g	0.01173U	0.003499U	-0.0126U	0.01029U
^{238}U	pCi/g	0.4099	0.413U	0.2079	0.6708U

[a] Abbreviations and data qualifiers are as follows: na – not analyzed; B – result is less than the practical quantification limit but greater than or equal to the instrument detection limit; U – undetected.
[b] Maximum value taken from biannual measurements.
Source: DOE, 2002b.

3.6.2.3 Soil Concentrations

Soil-sampling locations approximately 16 km (10 mi) from PORTS are used to determine background concentrations in soils. Table 3-4 summarizes the 2001 soil monitoring results.

3.6.2.4 Vegetation

The United States Enrichment Corporation monitors background concentrations of fluoride, ^{99}Tc, and uranium in plants located approximately 16 km (10 mi) away from PORTS. Table 3-5 presents the background data obtained in 2001 for vegetation.

Table 3-4 Background Soil Concentration for Selected Radioactive Elements

Location	Alpha activity (pCi/g) [b]	Beta activity (pCi/g) [a,b]	99Tc (pCi/g) [a,b]	Uranium (µg/g) [b]
RS-10N	11.4	15.4	0.229	3.6
RS-10S	7.43	25.3	0.4	3.4
RS-10E	7.4	10.9U	0.166	2.8
RS-10W	15.9	12.5U	0.0481U	6.8

[a] U – undetected.

[b] Maximum value taken from biannual measurements.

Source: DOE, 2002b.

Table 3-5 Vegetation Monitoring Program Background Levels

Location	Fluoride (μg/g)[b]	99Tc (pCi/g)[a,b]	Uranium (μg/g)[a,b]
RS-10N	1.6	0.263U	0.25U
RS-10S	7.6	0.445	0.25U
RS-10E	2.1	0.09U	0.28
RS-10W	4.1	0.0721U	0.25U

[a] U – undetected.

[b] Maximum value taken from biannual measurements.

Source: DOE, 2002b.

3.6.2.5 Surface Water Concentrations

Background concentrations of radionuclides are provided for streams that are not considered impacted by PORTS operations. Streams used for background data are located approximately 16 km (10 mi) away from the site. Chemicals that are routinely monitored in surface water include total phosphate, fluoride, and 29 metals. Table 3-6 summarizes the background data collected in 2001 for surface water.

3.6.2.6 Ground-Water Concentrations

Background information regarding ground water at PORTS is not available. Concentrations of possible contaminants are compared to minimum concentrations established through RCRA and are not compared against background concentrations.

3.7 Land Use

The adjacent area surrounding the PORTS reservation is mostly rural with extensive farmland and forests. The closest residential center is Piketon, which is about 6.5 km (4 mi) north of the reservation on U.S. Rt. 23. Pike County's largest community is Waverly, approximately 13 km (8 mi) north of the reservation. The largest cities within an approximate 80-km (50-mi) radius are Portsmouth and Chillicothe, Ohio (USEC, 2003a).

Table 3-6 Surface-Water Monitoring Background Results [a]

Location	Parameter	Number of Samples [b]	Units	Minimum [c]	Maximum [c]
RS-10S	Alpha Activity	12 (11)	pCi/L	0	4
	^{241}Am	1 (1)	pCi/L	<0.0219	
	Beta Activity	12 (6)	pCi/L	<2.3	13
	^{237}Np	1 (1)	pCi/L	0	
	^{238}Pu	1 (1)	pCi/L	<0.1186	
	$^{239/240}$Pu	1 (1)	pCi/L	<0.089	
	^{99}Tc	12 (12)	pCi/L	0	<9
	Uranium	12 (11)	μg/L	<1	1.62
	$^{233/234}$U	1 (1)	pCi/L	<0.2303	
	^{235}U	1 (1)	pCi/L	0	
	^{236}U	1 (1)	pCi/L	<0.0364	
	^{238}U	1 (1)	pCi/L	<0.0985	
RS-10E	Alpha Activity	12 (12)	pCi/L	0	<4
	^{241}Am	1 (1)	pCi/L	<0.0689	
	Beta Activity	12 (10)	pCi/L	0	12.7
	^{237}Np	1 (1)	pCi/L	<0.0247	
	^{238}Pu	1 (1)	pCi/L	<0.074	
	$^{239/240}$Pu	1 (1)	pCi/L	0	
	^{99}Tc	12 (12)	pCi/L	0	<6
	Uranium	12 (11)	μg/L	<1	3.08
	$^{233/234}$U	1 (0)	pCi/L	0.6806	
	^{235}U	1 (1)	pCi/L	<0.1145	
	^{236}U	1 (1)	pCi/L	0	
	^{238}U	1 (1)	pCi/L	<0.2703	
RS-10W	Alpha Activity	12 (12)	pCi/L	0	<2
	^{241}Am	1 (1)	pCi/L	<0.0248	
	Beta Activity	12 (9)	pCi/L	0	18.4
	^{237}Np	1 (1)	pCi/L	0	
	^{238}Pu	1 (1)	pCi/L	<0.022	
	$^{239/240}$Pu	1 (1)	pCi/L	0	

Location	Parameter	Number of Samples [b]	Units	Minimum [c]	Maximum [c]
	^{99}Tc	12 (11)	pCi/L	0	12
	Uranium	12 (12)	μg/L	<1	<1
	$^{233/234}$U	1 (0)	pCi/L	0.8383	
	^{235}U	1 (1)	pCi/L	0	
	^{236}U	1 (1)	pCi/L	<0.688	
	^{238}U	1 (1)	pCi/L	<0.062	

[a] Based on 2001 monitoring data. The derived concentration guide (DCG) for each radionuclide is as follows: ^{241}Am, 30 pCi/L; ^{237}Np, 30 pCi/L; ^{238}Pu, 40 pCi/L; $^{239/240}$Pu, 30 pCi/L; ^{99}Tc, 100,000 pCi/L; $^{233/234}$U, 500 pCi/L; ^{235}U, 600 pCi/L; ^{236}U, 500 pCi/L; ^{238}U, 600 pCi/L. All results are well below these DOE standards. DCGs are not available for the other radiological parameters (alpha activity, beta activity, and total uranium).

[b] The number in parentheses is the number of samples that were below the detection limit.

[c] The maximum is not calculated for parameters that were sampled once.

Source: DOE, 2002b.

The area within the PORTS security fence is a fully developed industrial area. The grounds surrounding buildings and other fixtures are maintained as lawns and support various species of grasses and herbaceous plant species that are mowed periodically. No unique vegetation types exist within the boundaries of the reservation, and no threatened or endangered species of vegetation are known to be present on the site (DOE, 1995).

The land in the Region of Interest (ROI) consists primarily of farmland (including cropland, woodlot, and pasture) and forest (including Pike State Forest and portions of Wayne National Forest). The ROI for this Environmental Assessment (EA) encompasses a four-county area of southern Ohio that surrounds PORTS. These counties are Jackson, approximately 10 km (6 mi) to the east; Pike, where PORTS is located; Ross, approximately 10 km (6 mi) to the north; and Scioto, approximately 4 miles to the south of PORTS. This ROI is an approximately 50 km (31 mi) radius from PORTS. Table 3-7 summarizes the percentage of land use within the ROI attributable to urban, agriculture, wooded, and other uses.

Table 3-7 Percentage of Different land Uses in the ROI in 2000

County	Total Hectares	Urban	Agriculture	Wooded	Other[a]
Jackson	109,126	2%	32%	60%	6%
Pike	114,917	1%	27%	66%	6%
Ross	179,348	1%	48%	45%	6%
Scioto	159,755	2%	21%	72%	5%

[a] Other: Water/barren/scrub.

Source: ODOD, 2003.

Lands within or adjacent to the Scioto River floodplain are farmed intensively, particularly with grain crops such as corn and wheat. Other products such as potatoes, cabbage, and fruits are also cultivated in the area. Hillside terraces are more commonly used for cattle pasture. Both dairy and beef cattle are raised near the PORTS site. Other farm animals such as horses, pigs, sheep, goats, and chickens are raised to a lesser extent. Commercial woodlands (excluding sapling-seedling stands) are predominantly saw-timber stands. Pole-timber stands are of lesser proportion.

The vegetation of Pike County is represented by three major forest types, all of them second growth: mixed mesophytic (upland mixed hardwoods), mixed oak (oak-hickory), and bottomland hardwoods. The upland hardwoods areas include green ash, northern red oak, tulip poplar, red maple, and several additional species. The oak-hickory areas include white oak, northern red oak, post oak, shagbark hickory, pignut hickory, and various other associated species. The bottomland hardwoods include sycamore, sugar maple, flowering dogwood, and American beech as well as less important species. Several areas that once were cleared have been allowed to lie fallow and are now in various stages of succession. Several small plantations of pines are located on the reservation, and several small wetland areas have developed around holding ponds and in ditch lines (DOE, 1995).

Offsite recreational areas include the Brush Creek State Forest, a 0.5 square-mile portion that is within 8 km (5 mi) southwest of the PORTS reservation. This area is used primarily by hunters and mushroom harvesters, so its usage is very light (USEC, 2003b).

Usage of Lake White State Park, located approximately 9.7 km (6 mi) north of the site, is occasionally heavy and concentrated on the 43.3 ha (107 acres) of land closest to the lake. Most of the land surrounding the lake is privately owned. The 141.6-ha (350-acre) Lake White offers recreation such as boating, fishing, and swimming. There are 23 campsites for primitive overnight camping (USEC, 2003b).

The only significant industry in the vicinity is located in an industrial park south of Waverly. The businesses include a cabinet manufacturer and an automotive parts manufacturer (USEC, 2003b).

3.8 Historic and Cultural Resources

Historic and cultural resources are evaluated because of NEPA requirements and Section 106 of the *National Historic Preservation Act*, which protect historic properties from potential adverse impacts resulting from Federal agency actions. Historic, archaeological, and traditional cultural resources should be analyzed in sufficient detail to provide the basis for subsequent analysis and assessment of possible impacts (NRC, 2001). Adverse effects consist of any action that would diminish the property's location, design, setting, materials, workmanship, feeling, or association. If these resources are found to be impacted, then measures may need to be taken to avoid, minimize, or mitigate any adverse effects as required by 36 CFR Part 800.

PORTS is located within a region where Adena and Hopewell Indian mounds have existed. Additionally, several historic Native American Indian tribes are known to have had villages nearby (USEC, 2003a). Upon being contacted regarding this EA, the Ohio State Historic Preservation Office (SHPO) stated that the SHPO made a finding of no adverse effect for the Lead Cascade. Further, the SHPO stated that the proposed action meets the National Register Criteria for Evaluation (NRCE) (36 CFR 60.4) Criterion A because of the site's significance in the development of nuclear energy potential in post-World War II U.S. history (Snyder, 2003). Criterion A identifies properties that are associated with events that have a significant contribution to U.S. history. Cultural resources are defined as any prehistoric or historic district, site, building, structure, or object considered important to a culture, subculture, or community for scientific, traditional, religious, or any other reason. When these resources meet any one of the NRCE, they may be termed historic properties and are potentially eligible for inclusion on the *National Register of Historic Places*. Thus, PORTS may be considered for addition to the *National Register* at some point in the future.

3.9 Transportation

Figure 3-4 shows the various transportation routes for roads, rail, water, and air.

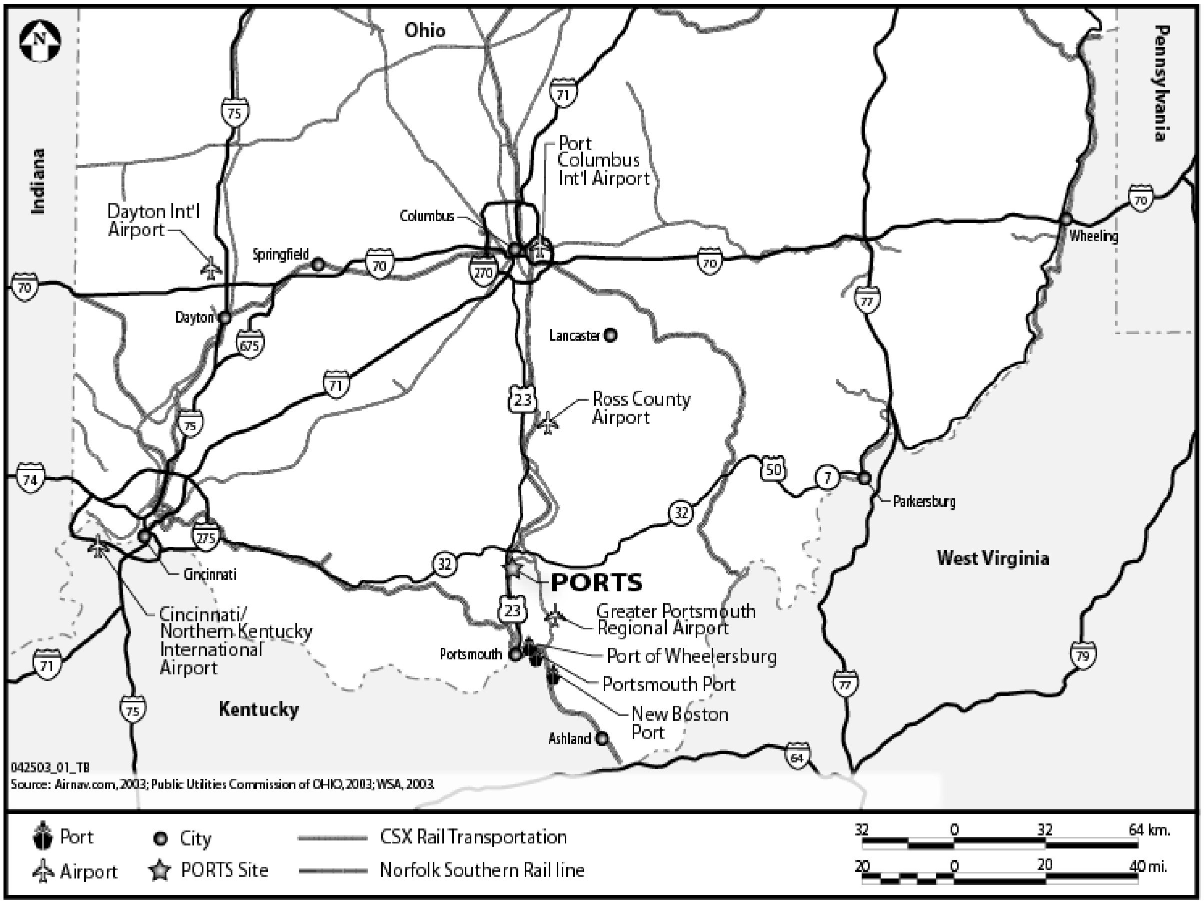

Figure 3-4 Transportation Routes

3.9.1 Roads

The PORTS reservation is served by southern Ohio's two major highways: U.S. Rt. 23 and Ohio SR 32. The site is 5.6 km (3.5 mi) from the intersection of the U.S. Route 23 and Ohio SR 32 interchange. Both routes are four lanes with U.S. Rt. 23 traversing north-south and Ohio SR 32 traversing east-west. Access is by the Main Access Road, a four-lane interchange with U.S. Rt. 23. This road accommodates the traffic on the site and is closed to general public access.

Approximately 113 km (70 mi) north of the site, U.S. Rt. 23 intersects I-270, I-70, and I-71. Trucks also may access I-64 approximately 32.2 km (20 mi) southeast of Portsmouth. SR 32 runs east-west from Cincinnati and through Piketon to Parkersburg, West Virginia. To the west, SR 32 provides access to Cincinnati's three interstate highways, I-71, I-74, and I-75. To the east, SR 32 is linked with I-77.

State highways in Tennessee that may be used to transport centrifuges and other components to the PORTS include Tennessee SR 58, 61, 62, 95, and 162 (Pellissippi Parkway). These highways lead to Boeing Road where the centrifuges are manufactured. The distance between Oak Ridge, Tennessee, and Piketon, Ohio, is approximately 555 km (345 mi) by road. Major transportation routes to and from Oak

Ridge, Tennessee, are via two interstate highways, I-40 and I-75, and U.S. highways 11, 25W, and 70 (USEC, 2003a).

Since September 2001, all site traffic utilizes the Main Access Road from U.S. Rt. 23. All other access roads are currently closed, and the reservation is closed to general public access. Access to the reservation is controlled by the security force. This has reduced the amount of traffic on Perimeter Road.

U.S. Rt. 23 has an average daily traffic volume of 13,990 vehicles, while Ohio SR 32 has an average daily volume of 7,420 vehicles (traffic in both directions is included in these values). U.S. Rt. 23 is at 60 percent of design capacity with Ohio SR 32 at 40 percent of design capacity. The Ohio Department of Transportation supplied this data from a 1999 traffic study. Load limits on these routes is controlled by the Ohio Revised Code at 38,556 kg (85,000 lbs) gross vehicle weight (gvw). Special overload permitting is available.

The PORTS reservation road system is in generally good condition due to road repaving projects. Except during shift changes, traffic levels on the site access roads and Perimeter Road are low. Peak traffic flows occur at shift changes, and the principal traffic problem areas during peak morning/afternoon traffic are at locations where parking lot access roads meet Perimeter Road. The site has 12 parking lots varying in capacity from approximately 50 to 800 vehicles. Total parking capacity is for approximately 4,400 vehicles (USEC, 2003a).

3.9.2 Rail

A rail system is located on the site with several track configurations possible. The Norfolk Southern rail line is connected to the CSX Transportation Inc. line via a rail spur entering the northern portion of the site. The onsite system is used infrequently. The GCEP area is also connected to the existing rail configuration. Track in the vicinity of Piketon, Ohio, allows a maximum speed of 96.6 km/h (60 mph). The CSX Transportation Inc. line also provides access to other rail carriers (USEC, 2003a).

3.9.3 Water

The site can be served by barge transportation via the Ohio River at the ports of Wheelersburg, Portsmouth, and New Boston. The Portsmouth barge terminal bulk-materials-handling facility is available for bulk materials and heavy unit loads. All heavy unit loading is by mobile crane or barge-mounted crane at an open-air terminal. The Ohio River provides barge access to the Gulf of Mexico via the Mississippi River or the Tennessee-Tombigbee Waterway. Travel time to New Orleans is 14 to 16 days; to St. Louis, 7 to 9 days; and to Pittsburgh, 3 to 4 days. The U.S. Army Corps of Engineers maintains the Ohio River at a minimum channel width of 243.8 m (800 ft) and a depth of 2.74 m (9 ft) (USEC, 2003a).

3.9.4 Air

The nearest airport is the Greater Portsmouth Regional Airport located approximately 24 km (15 mi) south of the site. The airport has dual runways and T-hangars, and is served by Chasteen Aviation, Inc. Another nearby airport, the Ross County Airport, is located approximately 40 km (25 mi) north of Piketon. This facility is similar in size and makeup to the Greater Portsmouth Regional Airport. In addition, three international airports are within a two-hour drive of the site: Cincinnati/Northern

Kentucky International Airport, Dayton International Airport, and Port Columbus International (USEC, 2003a).

3.10 Demographic and Socioeconomic Profile

The ROI for this EA encompasses a four-county area of southern Ohio that surrounds PORTS. These counties are Jackson, Pike, Ross, and Scioto.

3.10.1 General Demographic and Socioeconomic Patterns

PORTS is located in a rural area in Pike County, Ohio. The following information describes the demography and socioeconomics of the local and regional area.

3.10.2 Population and Housing

All of the counties are primarily rural in nature, except near the cities of Portsmouth in Scioto County and Chillicothe in Ross County. Over the last 20 years, population within the ROI has grown at a slightly lower rate compared to the State of Ohio. ROI population is projected to grow faster than the State during the current decade, increasing 6.2 percent between 2000 and 2010 compared to the State rate of 4.0 percent. Figure 3-5 shows a pinwheel that describes the current population distribution in a 15-mile radius around the site. This pinwheel was developed using SECPOP2000, a computer code that calculates population estimates using U.S. Census Bureau (USCB) data from the 2000 census (SNL, 2003).

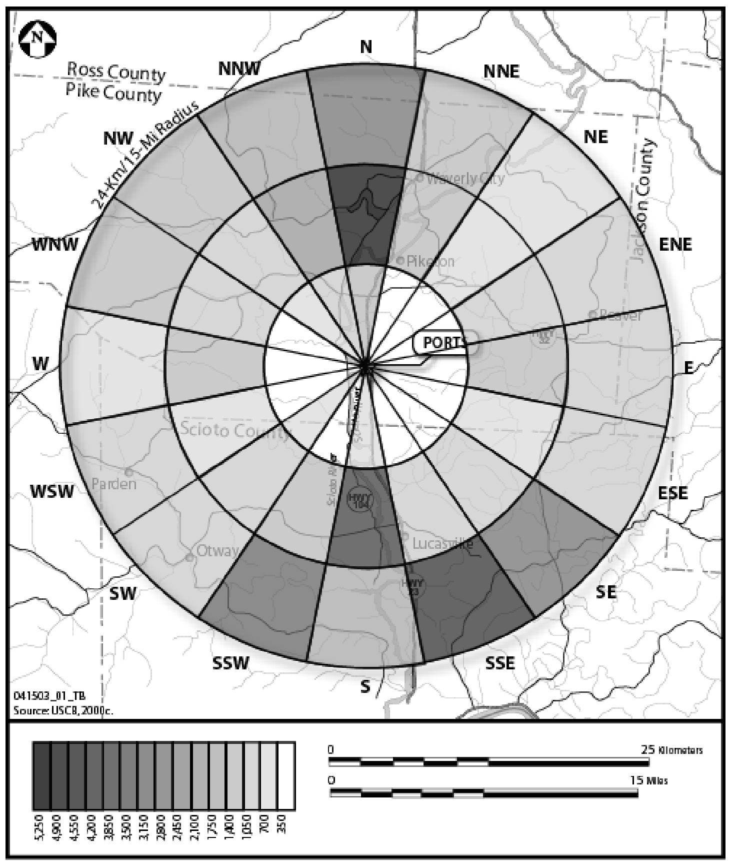

Figure 3-5 Current Population Distribution

Chillicothe, in Ross County, is the largest population center in the ROI with a population of 21,796 in 2000. Other population centers include Portsmouth (20,836) in Scioto County and Jackson (5,987) in Jackson County. The largest town in Pike County is Waverly (4,637), and the closest town to PORTS is Piketon (1,881) (USCB, 2000a). The vacancy rate of housing units, whether for sale or rented, ranged from 8 to 10 percent in 2000 (USCB, 2000b).

3.10.3 Employment and Income

Table 3-8 shows that the service sector provides the highest percentage of the employment in the ROI, almost 25 percent, followed closely by the wholesale and retail trade, manufacturing, and government sectors. Employment has shifted over the last decade from the government, construction, and farm sectors towards the service, wholesale and retail trade, and manufacturing sectors (USEC, 2003a).

The ROI experienced stable growth over the 10-year period of 1992 to 2001. According to the U.S. Department of Labor, the ROI labor force grew from 86,670 to 94,613, for a growth rate of 9.2 percent over that period. Employment growth outpaced labor force growth, increasing from 77,721 to 88,535, for a growth rate of 13.9 percent (BLS, 2003). Table 3-9 shows the ROI unemployment rates for the ROI over this 10-year period.

Per capita income in the ROI was $19,958 in 2000, a 54-percent increase from the 1990 level of $12,947. Per capita income in 2000 in the ROI ranged from a low of $19,158 in Pike County to a high of $21,849 in Ross County. The per capita income in Ohio was $27,977 in 2000 (BEA, 2002a).

Table 3-8 Percentage of Employment by Sector

	Jackson		Pike		Ross		Scioto		ROI	
Employment Sector	1990	2000	1990	2000	1990	2000	1990	2000	1990	2000
Services	21.6	18.9	16.7	16.0	21.7	25.0	28.2	31.1	23.4	24.7
Wholesale and Retail Trade	21.5	21.5	15.0	16.0	21.0	22.1	24.3	24.0	21.5	21.7
Government and Government Enterprises	12.7	10.7	15.6	12.3	21.2	19.0	19.4	18.6	18.6	16.6
Manufacturing	23.2	27.0	35.6	38.2	18.9	14.4	8.3	8.3	17.9	17.9
Construction	4.8	0.0	4.8	5.9	4.9	5.1	5.9	5.8	5.2	4.7
Finance, Insurance, and Real Estate	4.1	5.1	2.4	3.9	3.5	3.9	4.8	4.2	3.9	4.2
Transportation and Public Utilities	4.4	3.8	3.6	3.4	3.7	5.7	5.2	4.5	4.3	4.6
Farm Employment	6.0	4.8	5.5	3.6	4.3	3.6	3.0	2.5	4.3	3.4
Mining	1.3	2.4	0.3	0.0	0.1	0.0	0.2	0.1	0.3	0.4
Other Sectors	0.4	5.8	0.5	0.7	0.6	1.2	0.7	0.9	0.6	1.7

Source: BEA, 2002b.

Table 3-9 ROI Unemployment Rates in Percent

County	1992	2001
Jackson	9.2	7.2
Pike	11.7	8.0
Ross	9.2	5.1
Scioto	11.5	7.0
ROI Total	10.3	6.4
Ohio	7.3	4.2

Source: BLS, 2003.

PORTS presently employs approximately 1,660 workers, which is approximately 14 percent of the total 2001 workforce within Pike County. Of the 1,660 workers, approximately 1,180 are employed by the United States Enrichment Corporation while approximately 480 employees work for DOE, Bechtel Jacobs Company, and various subcontractors (BJC, 2003).

3.10.4 Tax Structure

The average property tax rates for Ohio cities are divided into three separate classifications: Class I Real (residential and agricultural); Class II Real (commercial, industrial, mineral, and public utility); and Class III Tangible Personal (general and public utility). For Waverly, in Pike County, the rate is $0.07412 per $1,000 for all three classifications in 2001; for Portsmouth, in Scioto County, the rate is $0.06013 per $1,000 for all three classifications in 2001; for Wellston, in Jackson County, the rate is $0.05500 per $1,000 for all three classifications; and for Chillicothe, in Ross County, the Class I rate is $0.05407, the Class II rate is $0.05394, and the Class III rate is $0.05402 per $1,000 (ODT, 2003a).

The State of Ohio personal income tax rate for incomes ranging from $20,000 to $40,000 is $445.80 plus 4.5 percent of excess over $20,000; for incomes ranging from $40,000 to $80,000, the personal income tax rate is $1,337.20 plus 5.2 percent of excess over $40,000 (ODT, 2003b). The State of Ohio also has a 5-percent sales tax. In addition to the State sales tax, each county in Ohio has a county sales tax. Jackson, Ross, and Scioto Counties have a county sales tax rate of 1.5 percent, and Pike County has a county sales tax rate of 1 percent (ODT, 2003b).

3.10.5 Community Services

Twenty-four public school districts provide public education for approximately 36,000 students in the ROI (ODE, 2003). More specifically, there are two school systems in the immediate area to the reservation — the Pike County and Scioto County Schools. In 2002, the combined enrollment of these schools was approximately 2,387 (USEC, 2003b).

Within the same area, there are three facilities that provide daycare or schooling for preschool-aged children and after-school care for school-aged children. Two of these facilities accommodate 390 children (USEC, 2003b).

The nearest hospital to PORTS is the Pike Community Hospital located approximately 12.1 km (7.5 mi) north of the facility on SR 104 south of Waverly. No other acute-care facilities are located in Pike County. There is an urgent-care facility, Adena Health Center, also on Rt. 104 near the hospital. In addition, two licensed nursing homes are located near Piketon and one is located in Wakefield; all are located within 8 km (5mi) of the site (USEC, 2003b).

Several State, county, and local police departments provide law enforcement in the ROI (USEC, 2003a). Pike County has 19 officers and provides law enforcement services to PORTS. Other counties in the ROI have a total of 101 full-time officers — 16 in Jackson, 62 in Ross, and 53 in Scioto Counties (FBI, 2000).

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4 ENVIRONMENTAL IMPACTS

4.1 Introduction

This chapter presents potential impacts associated with the construction and operation of the American Centrifuge Lead Cascade Facility (Lead Cascade) facility at the Portsmouth Gaseous Diffusion Plant (PORTS). This chapter will also provide the analytical basis for the impacts given in this Environmental Assessment (EA). Two options are presented — the proposed action (i.e., build, operate, and decommission the Lead Cascade at PORTS) and the no-action alternative. Chapter 2 discusses these options.

Impacts were separated into radiological and nonradiological. Radiological impacts include doses to the public and workers from routine operations and potential accidents, and to the environment from potential releases in the air, soil, or water. Proposed decommissioning activities will be considered when appropriate. The environmental consequences of these two alternatives could include direct effects on the ambient environment and its resources. These resources include air, water, soils, plants, animals, cultural artifacts, and people (including site workers and people in nearby communities). Consequences may be detrimental (e.g., increased airborne emissions of hazardous chemicals) or beneficial (e.g., jobs created by new construction and cleanup of contaminated soils).

The impact assessments in this EA have generally been performed in such a way that the magnitude and intensity of estimated impacts are unlikely to be exceeded during facility refurbishment, normal operations, or in the event of an accident. The use of this methodology ensures that all alternatives have been evaluated using the same methods and data, allowing an unbiased comparison of impacts.

The following factors are considered when evaluating the environmental impacts on the PORTS site and the surrounding area:

- The land where the proposed Lead Cascade is to be built is in a highly developed and impacted industrial area.

- Previously, the site has been extensively characterized in several U.S. Department of Energy (DOE) *National Environmental Policy Act* (NEPA) studies (DOE 2003, 2001a, 1999, and 1997).

- The current level of industrial activity on the site is significantly below the peak activity level that existed when the operation of the gaseous diffusion enrichment facilities was at full capacity.

The manufacture of the gaseous centrifuge components is proposed to occur at the East Tennessee Technology Park (ETTP) outside of Oak Ridge, Tennessee. The gaseous centrifuge components are then transported to the PORTS site. The environmental impacts from these activities are analyzed and discussed in a separate DOE EA (DOE, 2002a). The impacts during the installation of centrifuges are considered negligible.

4.2 Air Quality

As presented in Chapter 3, the air-quality impacts resulting from operation of the PORTS site are within the regulatory requirements or emission standards. This section examines whether the activities from the alternatives will have an incremental effect to the existing air quality, potentially affecting the regulatory requirements or emission standards to which the PORTS site must adhere.

4.2.1 No-Action Alternative

Under the no-action alternative, the PORTS site will continue as currently planned by DOE and USEC Inc. There will be no additional impacts or change in the impacts to air quality other than those changes occurring from continuing with the existing plans for the PORTS site, currently in cold standby status. The existing air quality at the PORTS site is in attainment with National Ambient Air Quality Standards (NAAQS) for all the criteria pollutants as presented in Chapter 3. The calculated combined dose from current USEC Inc. and DOE airborne sources from the PORTS site is 6×10^{-4} milliSievert (mSv) per year (0.060 millirem [mrem] per year), well below the 0.1 mSv per year (10 mrem per year) limit applicable to the PORTS site and the average 3 mSv per year (300 mrem per year) dose for an individual in the United States from natural sources of radiation (DOE, 2002b).

4.2.2 Proposed Action

As presented in Chapter 2, only buildings X-7726 and X-3001 will have activities relating to the assembly, testing, and operation of the gas centrifuges that could affect air quality. The existing ventilation systems currently in place in these buildings will be used to handle any air emissions to the outside air as a result of the proposed action.

4.2.2.1 Radiological

Using site data from 2001, USEC Inc. performed an analysis in the Environmental Report (ER) for the projected annual emissions from the Lead Cascade located in the X-3001 building (USEC, 2003a). The results included not only the annual average radionuclide concentrations and associated public doses, but also the annual average concentrations of airborne uranium and hydrofluoric acid (HF) for the maximum public impact. USEC Inc. assumed a projected activity emission rate for this facility of 0.1 millicuries (mCi) per week (0.0052 curies per year) of total uranium with a ^{235}U assay of 1 percent.

USEC Inc. applied the EPA dispersion computer code CAP88-PC for demonstrating compliance with the *U.S. Code of Federal Regulations* 40 CFR Part 61 Subpart H standards for atmospheric releases of radionuclides. The analysis results for the maximum offsite dose were 2.3×10^{-4} mSv per year (0.023 mrem per year) for a hypothetical neighbor along the SSW reservation boundary. The analysis results for onsite doses were found to be 7.7×10^{-5} mSv per year (0.0077 mrem per year) for the maximum annual radiation dose for the location of the X-751 Mobil Equipment Maintenance Shop. The onsite and potential offsite doses are well within the dose limits presented in 10 CFR Part 20 for workers (50 mSv/yr, or 5,000 mrem/yr) and members of the public (1 mSv/yr, or 100 mrem/yr).

4.2.2.2 Nonradiological

The operation of the Lead Cascade is not expected to significantly impact air quality (USEC, 2003a), and PORTS should remain in attainment with NAAQS for all the criteria pollutants. This is due to three factors. First, refurbishment and operational activities occur within the existing Gas Centrifuge Enrichment Plant (GCEP) buildings where best construction and occupational safety management practices can be applied to limit impacts on air quality. Second, a large (i.e., greater than 600 horsepower) stationary diesel engine used for emergency or backup electrical power is expected to run no more than 500 hours of operation during a power failure with emissions that, based on AP-42 emission factors of the EPA in 2003, would be well below the prevention of significant deterioration (PSD) increments. This would result in no further review by the EPA or the Ohio EPA (USEC, 2003a). Third and lastly, the limited quantities of volatile material emanating from the cascade closed-loop system and the proposed rigid monitoring of the gaseous centrifuges should minimize the impacts to air quality from nonradioactive material. Maximum airborne concentrations were calculated by the USEC Inc. to be

5.7×10^{-4} $\mu g/m^3$ for total uranium and 1.9×10^{-4} $\mu g/m^3$ for HF. These estimates are 12 million times less than the American Conference of Government Industrial Hygienists (ACGIH) threshold limiting value (TLV) of 2.3 mg/m^3 for exposure to HF and approximately 350 thousand times less than the 0.2 mg/m^3 TLV for uranium (ACGIH, 2003). The 0.2 mg/m^3 is also the recommended limits in 10 CFR Part 20 Appendix B, Table 2, footnote 3, for a 40-hour work week exposure.

4.3 Geology and Soils

The implementation of the no-action alternative and the proposed action being considered in this EA would not disturb the site geology and soils. Under the no-action alternative, the site will continue with the planned activities and with contamination levels provided in Section 3.3.3 remaining the same. The overall potential dose to the public from all pathways including air inhalation is about 0.0088 mSv per year (0.88 mrem/year) (DOE, 2002b). For the proposed action, only existing facilities will be used and no additional construction will take place outside the confines of the existing buildings. These facilities will still exist for the proposed action after the Lead Cascade project is completed and decommissioned with all activities occurring within the affected buildings. Therefore, there are no foreseen impacts to existing conditions of the PORTS site geology or soil.

4.4 Surface Water

The surface water within the PORTS site and surrounding area has been impacted from past activities within PORTS as well as from farming and other activities. This section examines whether the activities from the alternatives will have an incremental effect to the existing surface-water impacts.

4.4.1 No-Action Alternative

Under the no-action alternative, the PORTS site will continue as currently planned by DOE and USEC Inc. There will be no incremental impacts or change in the impacts to aspects relating to current site surface-water conditions or due to changes that might result from continuing with the existing plans for the PORTS site, which is currently in cold standby status (DOE, 2002b).

4.4.2 Proposed Action

The activities proposed for refurbishment, operation, and anticipated decommissioning will have little impact on the surface water because of low use of water resources for the Lead Cascade facility, and the relatively low quantity of hazardous material inventories contained within the Lead Cascade facility. This conclusion is applicable to both radiological and nonradiological impacts.

4.5 Ground Water

The ground-water resources within the PORTS site and surrounding area have been disturbed by past activities at PORTS. The extent of contamination is primarily from trichloroethylene (TCE) and technetium-99 (^{99}Tc) in ground water within the PORTS site. The following discussion concerns whether the activities from the two alternatives would have an incremental affect on the existing ground water.

4.5.1 No-Action Alternative

Under the no-action alternative, the PORTS site would continue as currently planned by DOE and USEC Inc. There would be no further impacts or change to the current site ground-water conditions. It is expected, however, that the ground-water conditions and quality at the site will be enhanced as the

Corrective Action Program progresses under the State of Ohio EPA's *Resource Conservation and Recovery Act of 1976* (RCRA) to address existing contamination (DOE, 2002b). This program would continue if the no-action alternative was selected.

4.5.2 Proposed Action

The activities proposed for refurbishment, operation, and anticipated decommissioning would not have any noticeable additional impact on the onsite ground-water quality. The low level of existing contamination, the use of existing facilities, the low consumption of ground-water resources for the Lead Cascade activity, as well as the relatively low quantity of hazardous material inventories contained within the facility are contributing factors for this projection. No impact on the offsite ground water is anticipated since the onsite ground-water contamination has not migrated offsite over the lengthy time of operations at PORTS and the ongoing environmental restoration activities (DOE, 2002b). The environmental restoration activities in 2001 for ground water include the construction of a barrier wall at the X-749 landfill and ground-water extraction wells in Quadrant I where the proposed action would be located. Because the proposed action is occurring within an existing building, there would be no impacts from the proposed action on the approved RCRA corrective action process (CAP).

The lack of impacts to ground water from the Lead Cascade activities would be applicable to both radiological and nonradiological impacts.

4.6 Ecology

The previous operation of PORTS has impacted the ecological resources within the site and its surrounding area. The following discussion concerns whether the activities from the two alternatives would have an incremental effect on existing ecological resources.

4.6.1 No-Action Alternative

Under the no-action alternative, the PORTS site activities will continue as currently planned by DOE and United States Enrichment Corporation. There would be no further impacts or change to the current site ecological resources.

4.6.2 Proposed Action

During the activities related to refurbishment, operation, and decommissioning of the Lead Cascade, effluent releases could lead to minor impacts on the site and surrounding ecology. Because the proposed action involves an industrial area with traditional limited landscaping between buildings at the site, a favorable habitat does not exist for species of concern as identified by the U.S. Fish and Wildlife Service (USEC, 2003a). Moreover, the estimated nonradiological and radiological effluent releases from the Lead Cascade are not significant enough to create any additional impacts. Therefore, no impacts to the ecological resources are anticipated to occur from the proposed action.

The level of safety required for the protection of humans is adequate for other animals and plants as well. Therefore, no additional mitigation efforts are necessary beyond those required to protect humans (IAEA, 1992). See Sections 4.11 and 4.12 for the analysis of accidents and cumulative impacts on humans.

4.7 Land Use

The PORTS site and surrounding area have undergone extensive industrialization and development within the past several decades. However, the current activities at existing facilities within the site are far below the peak activity level of the PORTS facilities prior to its cold standby status (DOE, 2002b).

4.7.1 No-Action Alternative

Under the no-action alternative, the PORTS site will continue operations as currently planned by DOE and United States Enrichment Corporation. No additional impact to land use is expected other than those changes occurring from continuing with the existing plans for the PORTS site currently in cold standby status.

4.7.2 Proposed Action

The activities proposed for refurbishment, operation, and anticipated decommissioning will utilize existing facilities. Under the proposed action, existing facilities will be used, and no construction will take place outside the confines of existing buildings. No additional land will be used for the Lead Cascade project. The Lead Cascade project is contained within approximately 25 percent of the land (121 ha, or 300 acres, of the total 486 ha, or 1,200 acres) of the industrial site within the Perimeter Road. Other Lead Cascade support operations will use existing site-wide services or programs (e.g., laboratory analysis, fire protection, security, medical, emergency management, waste management, and environmental monitoring). These activities will not affect the site’s land use. Because of the low level of activities associated with cold standby status, the use of existing facilities and support services for the Lead Cascade project, and the limited time that the Lead Cascade will be in operation, the proposed action would have a small impact on land use and no impact to visual resources within the PORTS site and the surrounding area.

4.8 Historic and Cultural Resources

The implementation of the alternatives would not disturb the historic and cultural resources of the site. Under the no-action alternative, the site will continue with currently planned activities. Under the proposed action, existing facilities will be used and no construction will take place outside the confines of existing buildings. These facilities will remain intact after the Lead Cascade project is completed and decommissioned, with all activities occurring within the affected buildings. Therefore, because all of the activities under both alternatives will remain on the site, there are no foreseen impacts to historic and cultural resources.

4.9 Transportation

The transportation impacts are a result of employee commuters and the influx and efflux of trucks carrying materials or waste, including the import of the Lead Cascade centrifuge components from the construction site at ETTP outside of Oak Ridge, Tennessee. The environmental impact of the shipment of these centrifuge components has been analyzed and presented in another NEPA document, DOE/EA-1451, *Environmental Assessment for the Leasing of Facilities and Equipment to USEC Inc.*(DOE, 2002a). The EA described the transportation activities to be weekly for large components using a standard-size tractor-trailer, while small vehicles are intended for smaller components several times a week. The EA concluded that the transportation impacts were considered to be minimal because no radiological materials are included in the shipments (DOE, 2002a).

4.9.1 No-Action Alternative

Under the no-action alternative, the PORTS site operation will continue as currently planned by DOE and United States Enrichment Corporation. Commuter traffic from the 1,272 workers and from the shipments of material and waste is expected to remain as it was in 2001 (DOE, 2002b). Furthermore, the shipments of the centrifuge components manufactured at ETTP will not occur. Accordingly, there will be no increase in transportation risks under this alternative beyond those projected under the current conditions for the site.

4.9.2 Proposed Action

The impacts from transportation activities related to the proposed action would be derived from the increased commuter traffic and material (radiological and nonradiological) shipments associated with PORTS operations. These will include the shipments of centrifuge components from the ETTP to the PORTS site and volume-reduced old centrifuges and components from the site to an authorized classified contaminated waste disposal facility. The environmental impacts related to each of these transportation elements will be evaluated below.

4.9.2.1 Radiological

During the disassembly of the old contaminated centrifuges, it is anticipated that decontamination of the components will remove the majority of the nonfixed radioactive material. These decontamination solutions would be handled in a manner consistent with DOE and NRC requirements. Radioactively contaminated liquids (oil) in amounts ranging up to 50,725 liters (L) (13,400 gal) will also need to be shipped offsite for disposal. If it is assumed that no decontamination was conducted for the purposes of this EA, the amount of LLRW that would be disposed offsite, along with the old centrifuges in an authorized LLRW disposal facility, would be small in comparison to the 3.5 million kg (7.8 million lbs) LLRW shipped from PORTS in 2001 to Envirocare (DOE, 2002b). The old centrifuges (approximately 9,817 cubic meters [m^3], or 346,684 cubic feet [ft^3] over a 3- to 4-year period) that will be dismantled will be packaged in drums/boxes and shipped in Sea Land containers to an authorized classified, contaminated waste disposal facility. Noncontaminated and declassified reusable components will be made available for resale (DOE, 2003).

Up to 250 kg (551 lbs) of uranium hexafluoride (UF_6) will be used in the Lead Cascade project. This material is a portion of an existing stockpile located on the PORTS site and is a small fraction of the total quantity of UF_6 within the site boundaries (USEC, 2003a). This onsite shipment would amount to a very small impact.

According to USEC Inc., up to 125 m^3 (4,400 ft^3) of solid, and about 4.5 m^3 (1,200 gallons [gal]) of liquid, low-level radioactive waste (LLRW) is projected to be produced annually over the duration of Lead Cascade operations (USEC, 2003a). This is equivalent to approximately five shipments per year of RCRA waste and five shipments per year of LLRW/MW (USEC, 2003c). This number is very small when compared to the daily traffic volume of 13,990 vehicles on U.S. Route 23.

USEC Inc. is committed to the storage and disposal of these LLRW in a manner consistent with NRC regulatory requirements. For the purpose of this EA, it is assumed that all of this waste will be shipped offsite to a licensed LLRW disposal facility such as Envirocare. This quantity of waste is relatively small as compared to the approximately 7,651 m^3 (217,000 ft^3) of LLRW generated at PORTS during 2001 (DOE, 2002c), and the approximately 3,000 m^3 (105,944 ft^3) LLRW shipped offsite from the PORTS site during the same year to Envirocare (DOE, 2002b). (It is assumed that 1 m^3 of waste equals 1 metric ton of waste [DOE, 2002c].) These transportation activities associated with the proposed action would have a minimal impact if compared to the transportation impacts that are normally occurring at PORTS. These small transportation impacts of the proposed action are bounded by the estimated dose of 0.0003 mSv (0.03 mrem) for an MEI exposed to approximately 8,800 truck shipments of U_3O_8 conversion products from PORTS to Envirocare (DOE, 2003).

4.9.2.2 Nonradiological

The nonradiological impacts from transportation are from vehicle-related physical hazards that result from physical trauma created by traffic accidents. Such impacts are not related to the shipment's cargo. The physical hazards represent fatalities from mechanical causes and are determined from fatality rates based on national average statistics maintained by the U.S. Department of Transportation (DOT) for truck and rail transportation.
The nonradiological transportation impacts comprise local traffic as well as interstate transportation of the centrifuge components. The additional local traffic from the number of workers for the Lead Cascade is a small fraction of the existing total workforce (less than 4 percent) and thus would not have a significant impact.

Various chemicals and other materials would be transported to PORTS to support the Lead Cascade project. The quantity is proposed to be a small fraction of the chemicals and material necessary to support the other activities at the PORTS site (USEC, 2003a). Therefore, there should not be a noticeable change with this alternative on the total transportation impacts of the site.

The impacts relating to the transportation of the centrifuge components have already been evaluated in DOE/EA-1451 (DOE, 2002a). A total of 160 shipments was estimated to transport centrifuge components from ETTP to PORTS. This number is very small when compared to the daily traffic volume of 13,990 vehicles on U.S. Route 23. The risk associated with total vehicular fatalities from these activities is 0.0007 fatalities, which can be considered very low. Total vehicle fatalities projected for probable accidents due to the 160 shipments is estimated to be less than 0.007 (USEC, 2003a). These impacts are primarily associated with the construction of the Lead Cascade and would not result in long-term impacts.

4.10 Demography and Socioeconomic

Based on the 2000 census, the Region of Influence (ROI) for the Lead Cascade project is comprised of the counties of Jackson, Pike, Ross, and Scioto with a total population of 212,876 and a labor force of 94,613. The PORTS site currently employs approximately 1,272 workers of whom 1,170 live within the ROI (USEC, 2003a).

4.10.1 No-Action Alternative

Under the no-action alternative, no changes are anticipated in the demography and socioeconomic conditions of the ROI beyond those occurring from the continuing operation of the PORTS site, which is currently in cold standby status and undergoing environmental remediation.

4.10.2 Proposed Action

USEC Inc. has predicted the peak labor force as 45 additional employees during the implementation of the proposed action. Refurbishment activities will employ an average of 25 workers for a 13-month period. Upon startup of the Lead Cascade, approximately 45 full-time employees will operate the facility up to five years. It is expected that much of the technical and operational expertise is available within the

ROI existing labor pool. The decommissioning labor force would also draw upon the existing labor pool or proceed with the Lead Cascade workforce at the end of operations that is estimated to be about 23 workers for the 12-month decommissioning effort (USEC, 2003b).

The Lead Cascade labor force for all activities or phases represents about a 2- to 4-percent increase in the PORTS site labor force and significantly less than a 1 percent change in the ROI labor force. This incremental increase represents only a small impact to the PORTS site and a minimal positive economic impact to the surrounding ROI for all segments of the area's demographics and socioeconomics.

4.11 Accidents

Pursuant to 10 CFR Part 70, Subpart H, USEC Inc. prepared an Integrated Safety Analysis (ISA) to document its evaluation of the consequences of potential accidents at the proposed Lead Cascade Facility. The ISA also documents the measures that USEC, Inc. proposes to reduce the risks of credible accidents. Accidents that are within the scope of the ISA include those involving licensed material (UF_6) and hazardous material produced from licensed material (HF). NRC has reviewed the ISA, and proposed Items Relied on for Safety (IROFS) described therein, and the proposed management measures that will ensure the reliability and availability of IROFS. NRC's evaluation of the USEC Inc. ISA are described in the Safety Evaluation Report (SER). In the SER, NRC staff finds that USEC Inc. has provided reasonable assurance that the risks of each credible high-consequence and intermediate consequence event meet the NRC's performance requirements.

Accidents relating to the refurbishment and decommissioning phases of the Lead Cascade will be the same as the industrial accidents that would be expected to occur from typical construction activities. Because of the small workforce for these two phases, established work control documentation requirements (e.g., procedures and work orders), and other conduct of operations requirements (e.g., housekeeping, training, configuration management, turnover, etc.), it is expected that the possibility of accidents during refurbishment and decommissioning would be further reduced. Therefore, the impacts from accidents expected from refurbishment and decommissioning activities should be minimal.

4.12 Cumulative Impacts

Cumulative impacts for this EA are defined in 40 CFR 1508.7 of the Council of Environmental Quality Regulations implementing NEPA as:

> *The impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor, but collectively significant, actions taking place over a period of time.*

Previous NEPA documents for PORTS present the cumulative impacts from actions of past decisions and any reasonably foreseeable future actions at PORTS (DOE, 2001a; DOE, 2001b; and DOE, 1997). The recently published preliminary draft Environmental Impact Statement (EIS) for the proposed depleted UF_6 conversion facilities at PORTS was also reviewed to ensure that any foreseeable potential actions at the site are taken into consideration (DOE, 2003). The results of these reviews demonstrate that the cumulative environmental impacts at PORTS from the construction, operation, and decommissioning of the Lead Cascade are not consequential and are small. Examples include the following situations:

- Air Quality: Air emissions from current and future actions from the gaseous diffusion plant do not violate any of the NAAQS. Proceeding with the proposed action, in combination with existing air emissions, will also not violate any of the NAAQS.

- The maximally exposed individual (MEI) annual dose from the waste management activities was determined to receive a radiation dose from airborne radionuclides of 0.0026 mSv (0.260 mrem) (Section 4.4.12 of DOE, 1997) while the proposed action will increase the MEI dose by 2.3×10^{-4} mSv per year (0.023 mrem per year).

- During 2001, approximately 3,000 m^3 (105,944 ft^3) from various waste streams at the PORTS site were disposed offsite, while the proposed action is estimated to only annually produce 125 m^3 (4,400 ft^3) of solid and 4,540 liters (1,200 gal) of liquid LLRW. Approximately 9,817 m^3 (346,684 ft^3) of classified, contaminated waste will be shipped offsite over a 3-4 year period.

Therefore, for all areas of environmental impacts, cumulative impacts for the PORTS site will be negligible or insignificant.

4.13 Evaluation of Significance

As presented in NUREG-1748, an EA is used to provide sufficient information for determining whether to prepare an EIS (NRC, 2001). To support this determination, Section 3.2.6.3 of NUREG-1748 presents a series of questions to be considered to assist in determining whether there are significant impacts. Reviewing these questions with respect to the impacts (direct or indirect) of the proposed action for each environmental category results in a “no” answer for all of them. Therefore, the environmental impacts that could result from the proposed action of implementing the Lead Cascade would not be significant.

4.14 NRC Staff Recommendations

Based on the evaluation in this EA, the NRC staff has concluded that licensing the Lead Cascade for construction and operation of a test and demonstration facility for a uranium enrichment process at the PORTS will not result in a significant impact to the environment. The staff has not identified any mitigating measures that should be implemented beyond those proposed.

4.15 References

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5 MITIGATION MEASURES

For the proposed action, activities will occur within existing facilities that contain liquid collection systems and air filtration systems as discussed in Chapter 2. As discussed in Chapter 4, the proposed action would not cause an appreciable increase or damage to any of the environmental resources. Mitigation measures, other than those identified in the Integrated Safety Analysis (ISA), are not necessary. The ISA identifies potential accident sequences in the facility's operations, designates Items Relied On for Safety (IROFS) to either prevent such accidents or mitigate their consequences to an acceptable level, and describes management measures to provide reasonable assurance of the availability and reliability of IROFS. Management measures are utilized to maintain the IROFS so that they are available and reliable. Management measures are the principal mechanism by which the reliability and availability of each IROFS is ensured. They are described in Chapter 11.0 of the License Application for the American Centrifuge Lead Cascade Facility (USEC, 2003).

For the no-action alternative, no mitigative measures are necessary since existing facilities will not be used and appropriate mitigative measures are being taken for current activities.

5.1 References

USEC Inc. (USEC, 2003). "License Application for American Centrifuge Lead Cascade Facility at USEC's Facilities in Piketon, Ohio." LA-2605-0001. February 2003.

6 MONITORING

An extensive process and environmental monitoring program is in place at the Portsmouth Gaseous Diffusion Plant (PORTS) for the air, soil, surface water, and ground water. This chapter describes the monitoring programs and the impact of the American Centrifuge Lead Cascade Facility (Lead Cascade) on monitoring efforts.

6.1 Airborne Monitoring

Quantifiable airborne radioactive effluents from the Lead Cascade will be limited to the X-3001 process ventilation system that serves the purge vacuum (PV) and evacuation vacuum (EV) systems. The airborne effluent monitoring system for the Lead Cascade consists of a continuous air sampler for the ductwork of the ventilation system. This ventilation system is monitored in a similar fashion to other ventilation systems associated with the gaseous diffusion plant at PORTS. The air samplers draw a flow-proportional sample of the air stream through two alumina traps (a primary and a secondary trap) in series by way of an isokinetic probe. The primary sample traps are replaced weekly, and the secondary traps are replaced quarterly. In the event of an unplanned or elevated release, the applicable air samplers are changed out for immediate analysis as soon as the situation has stabilized. Alternatively, the sampling period may be extended, provided that the sampler and ventilation systems are operating at all times. The primary sample trap is also equipped with an automated radiation monitor to continuously monitor the accumulation of uranium in the sampler. This provides a real-time indicator of effluent levels for operational control of the ventilation systems (USEC, 2003b).

Airborne samples from the ventilation system are analyzed for uranium-234 (^{234}U), uranium-235 (^{235}U), and technetium-99 (^{99}Tc) concentrations. No ^{99}Tc is expected to be present in the Lead Cascade process system. ^{99}Tc is known to exist in process ventilation systems associated with the old gaseous diffusion plant, so all airborne samples are analyzed for this radionuclide (USEC, 2003b).

6.2 Soil Monitoring

The United States Enrichment Corporation collects soil samples in the process area of the PORTS reservation, on unused land on the PORTS reservation, and in offsite locations up to 10 miles from the site. Samples are analyzed for alpha and beta activity, total uranium, and ^{99}Tc. Analytical results from the offsite samples represent natural background radionuclides and deposition of airborne radionuclides from PORTS. Analytical results from samples collected in the process area of PORTS also represent background radionuclides and airborne deposition, but can also include radionuclides deposited from spills or other plant operations (DOE, 2002).

No additional soil monitoring beyond existing practices is required for Lead Cascade operations. No liquid effluent will be discharged during normal operations. Any spills and leaks of the cooling water will be collected by floor drains and underground collection tanks and sampled prior to release for treatment at either the Sewage Treatment Plant or containerized for disposal, depending upon results (USEC, 2003a).

6.3 Surface-Water Monitoring

Surface-water monitoring at PORTS was initiated in the 1980s. The U.S. Department of Energy (DOE) has eight discharge points, or outfalls, through which water is discharged from the site. Three outfalls discharge directly to surface water (unnamed streams that flow to the Scioto River and Little Beaver Creek), and three discharge to the sewage treatment plant before leaving the site through USEC Inc. Outfall 003 to the Scioto River. The remaining two discharge points discharge to holding ponds where solids can settle, chlorine can dissipate, and oil can be separated from the water prior to its release to ditches and streams that flow to the Scioto River (DOE, 2001a; DOE, 2002; DOE, 2003).

The United States Enrichment Corporation is responsible for 11 National Pollutant Discharge Elimination System (NPDES) outfalls at PORTS. Eight outfalls discharge directly to surface water (unnamed tributary to Scioto River, Little Beaver Creek, Big Run Creek, and the Scioto River). Two discharge to the sewage treatment plant that releases to Outfall 003, and one discharges to the south holding pond (Outfall 002). Surface-water monitoring of the Big Run Creek, East Drainage Ditch, Little Beaver Creek, North Holding Pond, unnamed southwestern drainage ditch, and West Drainage Ditch is conducted quarterly to assess the effect of the discharge of ground water to streams (as base flow) at PORTS (DOE, 2001a).

No additional surface-water monitoring beyond existing practices is required for Lead Cascade operations. No liquid effluent will be discharged during normal operations. Any spills and leaks of the cooling water will be collected by floor drains and underground collection tanks and sampled prior to release for treatment at either the Sewage Treatment Plant or containerized for disposal, depending upon results (USEC, 2003a).

6.4 Ground-Water Monitoring

Ground-water monitoring at PORTS was initiated in the 1980s. Ground-water monitoring has been conducted in response to regulatory requirements of:

- The Ohio Administrative Code.
- *Resource Conservation and Recovery Act* (RCRA) closure documents.
- An Administrative Consent Order three-party agreement between DOE, the U.S. Environmental Protection Agency (EPA), and the Ohio Environmental Protection Agency (OEPA).
- A Consent Decree between DOE and the State of Ohio.
- DOE Orders.

Because of the numerous regulatory programs, the Integrated Ground-Water Monitoring Plan (IGWMP) was developed to minimize the potential for confusion in interpreting requirements and to maximize resources for collecting the data needed for sound decision making. The IGWMP was also designed to establish all ground-water monitoring requirements for PORTS. In addition to the detection and assessment monitoring at PORTS, the integrated approach to ground-water monitoring includes perimeter exit pathway monitoring, sampling selected surface water locations, and sampling the PORTS water supply and surrounding residents' drinking water (DOE, 2001a).

Ground-water monitoring is conducted by dividing the site into four quadrants. In general, samples are collected from wells in each quadrant and are analyzed for metals, volatile organic compounds, and radiological constituents. Figure 6-1 shows the location of ground-water monitoring wells in Quadrants I and III as specified in the site's IGWMP.

Several contamination sources are monitored in Quadrant I: the Quadrant I Ground Water Investigative Area, the Classified Materials Disposal Facility (X-749A Landfill), the Peter Kiewitt Landfill (X-749B Landfill), and the X-749/X-120 ground-water plume. A total of seven source monitoring wells are used to monitor the source term in each of these sources (DOE, 2001b).

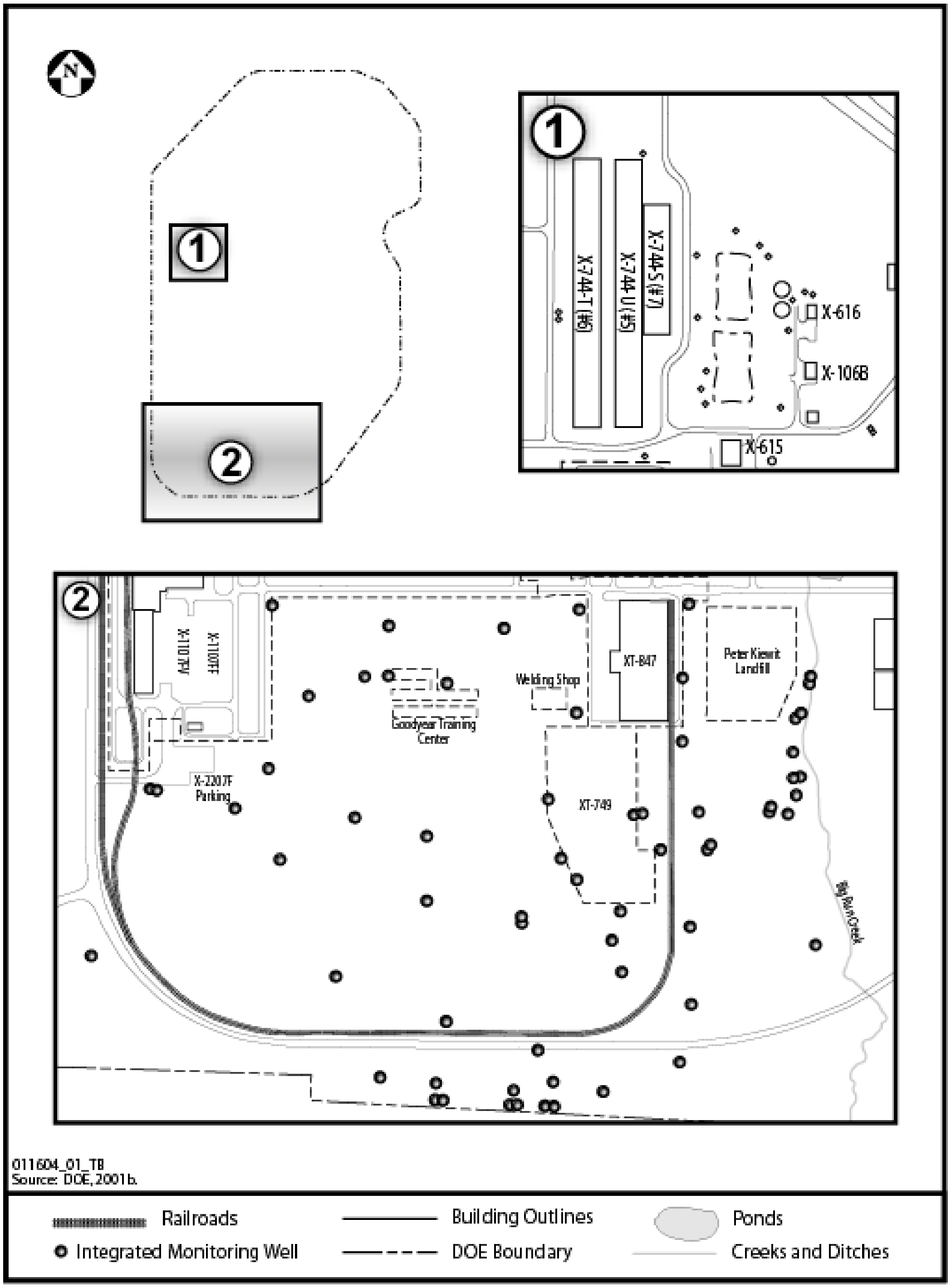

Figure 6-1 Ground-Water Monitoring Wells in Quadrants I and III

Monitoring wells were selected to serve one or more of the following broad technical objectives:

- Source/release monitoring.
- Plume monitoring.
- Remedial-action-effectiveness monitoring.

Source monitoring is designed to monitor, as close as is feasible, potential sources of ground-water contamination such as landfills and holding ponds. Plume monitoring is designed to assess the concentrations and extent of known contaminant plumes. Remedial-action-effectiveness monitoring is designed to evaluate the performance of interim remedial measures, corrective actions, or technology demonstrations (DOE, 2001a).

The closest contamination source in Quadrant III is the former X-616 Chromium Sludge Surface Impoundments. These impoundments were certified closed under RCRA in 1993 and are monitored semi-annually. These impoundments are currently monitored with 16 monitoring wells (DOE, 2001b).

No additional ground-water monitoring beyond existing practices is required for Lead Cascade operations. No liquid effluent will be discharged during normal operations. Any spills and leaks of the cooling water will be collected by floor drains and underground collection tanks, and sampled prior to release for treatment at either the Sewage Treatment Plant or containerized for disposal, depending upon results (USEC, 2003a).

6.5 References

U.S. Department of Energy (DOE, 2001a). “Environmental Assessment: Winterization Activities in Preparation for Cold Standby at the Portsmouth Gaseous Diffusion Plant, Piketon, Ohio.” DOE/EA-1392. June 2001.

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7 AGENCIES AND PERSONS CONSULTED

Table 7-1 lists the agencies and persons who were consulted for information and data for use in the preparation of this Environmental Assessment.

Table 7-1 Agencies and Persons Consulted

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